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HARD CHOICES

A Report on the Increasing Gap Between America's Infrastructure Needs and Our Ability To Pay for Them

A STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ECONOMIC GOALS AND
INTERGOVERNMENTAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

FEBRUARY 25, 1984

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LETTERS OF TRANSMITTAL

FEBRUARY 21, 1984.

Hon. ROGER W. JEPSEN,
Chairman, Joint Economic Committee,
Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to transmit herewith a study entitled, "Hard Choices. A Report on the Increasing Gap Between America's Infrastructure Needs and our Ability To Pay for Them."

This study, underway for the past two years, evaluates the condition of the public infrastructure in 23 states, and their infrastructure needs and financial capacity through the year 2000. Functional and regional analyses of the data are included. This study provides vital information not previously available on the condition of roads, bridges, and water and sewer systems around the country.

The assistance, support and dedication of dozens of individuals and organizations made this study possible. The National Infrastructure Advisory Committee, the sponsors, researchers and the participating universities are listed in the report. The Committee is also indebted to the 23 governors and their staffs who worked diligently with the researchers to produce the state reports. We also are grateful to the National Governors' Association, the National League of Cities and the U.S. Conference of Mayors, who provided encouragement and advice every step of the way.

Finally, the Committee is grateful to Marshall Kaplan, Dean, Graduate School of Public Affairs, University of Colorado, who implemented and directed this study and to Deborah Matz who supervised the work and edited this Report for the Joint Economic Committee.

Sincerely,

LEE H. HAMILTON,
Chairman, Subcommittee on Economic
Goals and Intergovernmental Policy.

FEBRUARY 15, 1984.

Hon. LEE H. HAMILTON,
Chairman, Subcommittee on Economic Goals and Intergovernmental Policy, Joint Economic Committee, Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to transmit herewith a study entitled, "Hard Choices. A Report on the Increasing Gap Between America's Infrastructure Needs and Our Ability To Pay for Them." This Report was prepared by Marshall Kaplan, Dean, Graduate School of Public Affairs, University of Colorado, under contract to the Joint Economic Committee. Deborah Matz supervised the work for the Committee, and served as editor of the final report.

While a wide range of organizations and staff assisted with this study, the Committee especially wishes to thank Dr. Frank Cesario, Peggy Cuciti and Dennis Donald of the Graduate School of Public Affairs, University of Colorado and Mr. Stephen Carlson of the Port Authority of N.Y.-N.J., for their role in the preparation of this report.

In addition, we thank Vicki Windmiller, of the Graduate School of Public Affairs, University of Colorado, for typing the manuscript. Pamela Reynolds of the Committee staff provided indispensable administrative and secretarial assistance.

The views expressed in this Report are the authors' and do not reflect the views of the Committee or its Members.

Sincerely,

James K. Galbraith,
Deputy Director,
Joint Economic Committee.

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PARTICIPATING STATES AND RESEARCHERS

State:	*Researchers and affiliation*
Alabama	Niles Schoening University of Alabama.
California	Fred Collignon University of California at Berkeley.
Colorado	James Ohi University of Colorado at Denver.
Florida	Earl Starnes, Neil Sipe University of Florida.
Indiana	Salmon Shah, Morton Marcus Indiana University.
Kentucky	Phillip W. Roeder, Dennis B. Murphy University of Kentucky.
Louisiana	James D. Schilling Louisiana State University.
Maine	Carl Veazie University of Southern Maine.
Maryland	David L. Puryear Johns Hopkins University.
Massachusetts	Karen Polenske Gerald Sussman Richard Tabors Lynn Todman Adrian Walter Massachusetts Institute of Technology and Harvard University.
Missouri	L. Kenneth Hubbell University of Missouri at Kansas City.
Montana	James Ohi University of Colorado at Denver.
New Jersey	Robert Lake Rutgers University.
New Mexico	Lee Zink University of New Mexico.
New York	Rae Zimmerman New York University.
North Carolina	Edward Kaiser William J. Drummond Kathleen M. Heady University of North Carolina at Chapel Hill.
Ohio	Michael Pagano Miami University (Ohio).
Oklahoma	Jean McDonald Tim Adams Tom Jones University of Oklahoma.
Oregon	Ken Tollenaar University of Oregon.
South Carolina	James Hite M. S. Henry B. L. Dillman Clemson University.
Tennessee	Niles Schoening University of Alabama.
Texas	William E. Claggert University of Texas at Dallas.
Washington	Phillip Bourque University of Washington.

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HARD CHOICES [1]

A Report on the Increasing Gap Between America's Infrastructure Needs and Our Ability To Pay for Them

EXECUTIVE SUMMARY

The United States faces a serious, but manageable, problem related to the condition and adequacy of its basic infrastructure—surface transportation, water supply and distribution, sewer collection and treatment facilities. A collapsing dam in Colorado and a bursting water main in New York have provided recent and dramatic examples of the country's aging and failing infrastructure. Less dramatic economic data indicate that in real terms the country's investment in its infrastructure has not kept pace with needs. Federal outlays have stayed at about one percent of the GNP since the early sixties. Significantly, state and local infrastructure outlays have declined from 2.2 percent of GNP in 1961 to 1.9 percent in 1981. Since the late seventies, total capital outlays for basic infrastructure have been reduced across all regions of the nation.

Continued reduced levels of investment and/or continued levels of investment insufficient to meet priority needs will result in many undesired consequences. Clearly, the nation will suffer a reduction in its economic development potential, productivity and jobs. Just as clearly, its residents will suffer a loss in the quality of their lives and the choices open to them.

STUDY HISTORY

The Joint Economic Committee of the U.S. Congress requested that the Graduate School of Public Affairs at the University of Colorado prepare an analysis of state infrastructure conditions and to develop an aggregate estimate of national infrastructure needs and available revenues through the end of the century. Individual case studies were prepared by universities in each state in conjunction with their respective governor's offices. Financial support came from the Cleveland Foundation, the Coalition of Northeastern Governors, Cummins Engine Co., the Ford Foundation, the Gates Foundation, the Joint Economic Committee, Lehman Brothers Kuhn Loeb, the University of Missouri at Kansas City, the

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[1] The study was directed by Marshall Kaplan, Dean of the Graduate School of Public Affairs, University of Colorado. Responsibility for the study's work program was shared by Dr. Peggy Cuciti and Dr. Dennis Donald of the Center for Public-Private Sector Cooperation, and Dr. Frank Cesario of the Graduate School of Public Affairs. Ms. Deborah Matz, project director for the Joint Economic Committee, helped define study objectives and advised the University of Colorado at Denver staff concerning congressional priorities. She also helped to maintain liaison with both the advisory committee and the states participating in the research effort. Stephen Carlson of the Port Authority of N.Y.-N.J. played an important role in facilitating the study.

Northeast-Midwest Institute, the Piton Foundation, the Port Authority of New York and New Jersey, the R. J. Reynolds Tobacco Co., the Rockefeller Bros. Fund, the Tennessee Valley Authority and participating states. A National Advisory Committee was appointed by the Joint Economic Committee to oversee and assist with the study as well as to provide Congress with policy options for addressing national infrastructure problems.

A NATIONAL PROBLEM

Nationally, a gap exists between anticipated revenues and basic infrastructure needs approaching 450 billion dollars through the year 2000. All regions of the country face sizable infrastructure gaps or revenue shortfalls. Yet, there are regional differences. The older industrial regions, primarily the Northeast and Midwest, are encountering growing obsolescence and deterioration of a capital plant put in place decades ago. The issue in these regions is one of revitalization. Conversely, the problem in the West appears to be brought about principally be growth.

Despite these regional variations, it is important to recognize that regional "averages" may mask the wide variation that occurs not only within the region but also within individual states. Many states noted that they concurrently faced the problem of facility revitalization and growth-induced infrastructure needs.

A CAPACITY DEFICIENCY

All states face substantial infrastructure needs and insufficient revenue with which to meet them. Obviously, the capacity of the respective states is in large part a function of their economic health. But, for all states, new and innovative financing mechanisms will have to be explored if the bulk of their public works needs are to be met.

The states have diverse capacity problems. Some states are limited by already-high taxes and debt which is at, or, near its mandated ceiling, others are restricted by relatively low tax bases. Investment options, in still other states, are constrained by self-imposed debt and tax limitations. Considerable uncertainty about the federal government's infrastructure role impedes development of efficient infrastructure management and development strategies. Concern about the tax-exempt bond market and its accessibility as a cost-effective source of revenue for state and local governments impedes long-term planning efforts.

The maintenance and development of public infrastructure is a problem which cuts across departmental and jurisdictional boundaries. This often translates into a fragmented approach for identifying and quantifying needs, developing comprehensive capital investment plans and priorities, and implementing investment plans. Many states lack data concerning infrastructure needs. Where data exist, its quality is uneven.

MAKING THE FEDERAL GOVERNMENT AN EFFECTIVE PARTNER

Historically, the federal government has played a major role in supporting infrastructure investment. It has also set infrastructure standards and helped define needs. Currently, there is considerable uncertainty about the federal government's future infrastructure role. The advisory committee recommends that state and local governments assume primary responsibility with respect to infrastructure management, financing and development. However, given the scale of investment required to respond to national infrastructure needs, a predictable and sustained federal commitment is, and will continue to be, important. Federal involvement is warranted in light of the importance of infrastructure development to the achievement of national economic goals. It is also warranted given the relationship between state needs and national infrastructure mandates, and the relationship between the infrastructure development capacity of individual states and the well being of their neighbors.

The advisory committee urges Congress to consider four basic priority amendments or changes in the current federal infrastructure role. First, the committee recommends creation of new financing mechanism or mechanisms to assist in financing infrastructure development. Second, Congress is urged to mandate development of a coordinated national infrastructure needs assessment program and unified capital budget evaluation. Third, Congress should initiate a review of infrastructure standards. Fourth, the committee proposes that Congress mandate an early evaluation of statutory and administrative rules now governing the use of existing federal infrastructure assistance programs. Finally, the advisory committee recommends that these proposals be premised on state and local governments enhancing their own fiscal capacity.

Specifically, the advisory committee recommends:

(1) Creation of a New Capitalization Mechanism

Several proposals to support state infrastructure banks or state and local government infrastructure programs are before the Congress. They deserve continued examination. The National Infrastructure Advisory Committee recommends that Congress consider an additional approach—creation of a National Infrastructure Fund (NIF).

Creation of a National Infrastructure Fund would establish a long-term partnership between all levels of government. It would provide a means to increase available resources for infrastructure development and help state and local governments secure capital funds at reasonable costs. It would supplement, not supplant, present federal, state and local programs.

NIF would be federally-chartered. It would fund no projects directly, but would establish a national pool of infrastructure capital. NIF would raise funds by selling taxable bonds directly in the private market or through the Federal Financing Bank. It would use its revenue stream to capitalize state infrastructure-financing entities to support state or local government infrastructure programs. If Congress provides for federal payment of interest on NIF debt, states could receive interest-free capital. In turn, their newly created state infrastructure-financing entities could make below-market rate loans to finance appropriate state or local government-defined infrastructure projects.

NIF capital would be repaid by state and local governments from varied taxes or user charges revenues. But until NIF bonds come due for repayment, state and local governments could recycle this capital to fund additional projects. Because state and local governments would repay NIF debt, the primary cost, apart from opportunity costs, to the federal government would be interest payments on NIF debt.

(2) Building Capacity at the Federal Level

The nation does not now have the ability to continuously define its infrastructure needs. As a result, development of coordinated and effective federal, state and local government investment and management strategies is impossible. Current budgeting practices hide direct and indirect federal infrastructure contributions, blur federal infrastructure objectives, and negate a reading of federal impact on current infrastructure development.

This study provides an initial estimate of needs. It should be used as a base upon which to build a more refined and comprehensive national assessments of needs and priorities. Congress should mandate development of a coordinated annual national inventory of basic infrastructure and an evaluation of basic infrastructure conditions.

Congress should insist that the federal budget separate capital expenditures from current operation outlays. It should also require formal development of a unified analysis of federal capital expenditures. This annual evaluation would relate federal infrastructure expenditures to annual national infrastructure need assessment, specific national infrastructure objectives and relevant federal revenue patterns.

(3) Reducing the Aggregate Cost of Infrastructure

Congress should initiate a comprehensive study of federal standards governing development of basic infrastructure. The study should be developed by an independent, respected, prestigious research group. It would be directed at measuring the relevance of current infrastructure standards, in light of changing societal values and real resource constraints.

(4) Development of More Flexible Grant Programs

Congress should re-examine statutory and administrative restraints inhibiting flexible state and local government use of existing infrastructure assistance programs. The national government should not significantly restrict how funds are used if they are used to meet general statutory commitments or objectives. Similarly, federal support when provided, should not skew the definition of state and local government infrastructure priorities or impede the development and implementation of effective investment strategies by state and local governments.

(5) Building State and Local Government Capacity

In light of resource constraints and diverse needs, state and local governments must extend their ability to plan and wisely manage infrastructure investments. Arbitrary constraints—whether constitutional, legislative, or administrative—should be evaluated and, if found to inhibit effective and equitable investment strategies, they should be amended or removed by state and local governments. Capital assessment and budgetary procedures should be improved in most areas of the country. Coordinated and innovative financial techniques should be explored and, where appropriate, utilized in conjunction with the private sector.

Infrastructure Analysis by Function

This study focused on three broad categories of infrastructure—surface transportation, wastewater collection and treatment, and water supply, treatment and distribution. They have received primary attention because of their crucial relation to sustaining the country's economic growth and development. Furthermore, they represent a sizable percentage of the state and local government capital outlay on infrastructure. Projections of future needs, revenues, and the resulting revenue shortfall are:

U.S. INFRASTRUCTURE PROJECTION, 1983 TO 2000

[Billions of 1982 dollars]

Component	Needs	Revenues	Shortfall
Highways and bridges	$720	$455	$265
Other transportation	178	90	88
Water	96	55	41
Sewer	163	114	49
Total	1,157	714	443

Transportation

Highways and bridges are a major component of the nation's transportation system. Although the federal government has played a major role in financing construction of the nation's highways system, almost the entire road system has been built and is operated by state and local governments.

Most states were able to provide some assessment of the condition of "major" roads in their states. These estimates are largely based on the U.S. Department of Transportation's assessment of the conditions and performance of the nation's system of highways. Few states addressed the conditions of and investment needs for local roads. Where provided, local road estimates tend to be based on incomplete data or simple rules of thumb. The major roads account for the largest share of traffic in most states.

Total estimated highway needs for the 23 case-study states are $466 billion over the 1983 to 2000 period in 1982 dollars. Applying the same per capita need figure to the nation yields a total needs figure of $720 billion. In all states, significant revenue shortfalls are anticipated despite gasoline tax increases in many states and at the federal level. For the nation, a revenue shortfall of $265 billion is projected.

Water Supply and Distribution Systems

Water supply and distribution proved to be the most difficult area to assess for many of the states. The complexity of the issue varied considerably by state. Availability of solid data appeared a pervasive problem.

The large number of private and public entities which are involved in supplying, storing, treating, and distributing water makes determining water needs a difficult exercise in every state. Massachusetts, for example, relies on 363 central water supply systems serving 293 cities and towns. Of these, 68 are private companies, 78 are fire and water districts and 217 are municipal water departments. New Jersey, on the other hand, relies heavily upon private water companies.

The water problems noted in the case studies included:

Deterioration of water supply and distribution systems.
Inadequate sources of water supply.
Overdrafting of underground aquifers.
Contamination of water supply.
Inadequate treatment facilities.

Based on the findings of this study, water needs are projected to be $62 billion in the case-study states, or $96 billion throughout the country through the year 2000 in 1982 dollars. This level of need is substantially more than recent capital expenditure levels and significantly greater than anticipated revenues.

Wastewater Collection and Treatment

The Federal Water Pollution Control Act Amendments of 1972 signified a national commitment to wastewater treatment. It committed billions of dollars to a Wastewater Construction Grant Program which stimulated significant improvements in sewerage collection and treatment facilities.

Since the passage of the 1972 Act, the Environmental Protection Administration has been actively involved in assessing needs. Working closely with state officials, EPA conducts a facility-by-facility survey of what investments will be required to comply with federal law. The EPA reports its needs estimates by category and for backlog and future needs.

Backlog needs: This is the estimate of the cost of providing treatment to the 1980 population for abatement of existing pollution problems.

Year 2000 needs: This is the estimate of the cost of addressing all treatment for the population projected to be in place in the year 2000.

Many of the states relied on the EPA estimates to develop their statewide estimates of sewerage treatment needs. Others derived their estimates from surveys of local officials who have the responsibility for construction, maintenance and operation of sewerage systems. Some states raised concerns about the comprehensiveness of the EPA figures and suggested that to fully account for growth and needed improvements, they would have to exceed the EPA figures.

Based on the state estimates of needs, and assuming the states which were studied and their per capita projections are typical of the nation, total investment needs are projected to be $163 billion in 1982 dollars through the year 2000. The revenue shortfall for sewerage treatment needs is projected to be $49 billion.

REGIONAL ANALYSIS

The 23 states which participated in this study were divided into five regions: Northeast, Midwest, South, South-Central, and West.

Each region has a minimum of 20 million residents represented by their respective case study states. In total, the states under study accounted for 64 percent of the 1980 U.S. population.

State profiles have been developed for five regions and 23 states:

Region:	*State*
Northeast	Maine.
	Massachusetts.
	New Jersey.
	New York.
Midwest	Indiana.
	Missouri.
	Ohio.
South	Alabama.
	Florida.
	Kentucky.
	Maryland.
	N. Carolina.
	S. Carolina.
	Tennessee.
South-Central	Louisiana.
	Oklahoma.
	Texas.
West	California.
	Colorado.
	Montana.
	New Mexico.
	Oregon.
	Washington.

During the past few years, a pervasive decline in real investment has occurred across all regions. On a per capita basis, the greatest capital spending (on highways, sewerage and water) has taken place in the West, South-Central and South while the lowest per capita outlays have been recorded in the Northeast and Midwest. This is, in part, attributable to the dominance of highway spending in the growing and more sparsely populated Western states.

Future spending needs reflect a surprising and, from a policy perspective, welcome trend toward coincidence between regions. Annual per capita requirements vary from $222 in the West to $351 in the Midwest. The Northeastern states and South-Central region illustrate mid-range per capita estimates. They vary from $245 in the South to $266 in the South-Central. Revenue expectations range from $82 in the South to $176 in the Midwest. Distinguishing revenues and expenditures solely on a regional basis makes the uniqueness of the states within the regions and, in fact, the great variability within the states themselves. The 23 evaluated states each have special needs related to the age, quantity and quality of their existing highway, water and sewerage systems. They also have special needs related to their geography, the spatial distribution of their populations, their climate, and their prospects for future growth.

KEY FINDINGS

The examination of future infrastructure needs and revenues indicates:

> For the 23 states studied, total infrastructure needs (highways, other transportation, water, sewerage) for the 1983 to 2000 period are projected to be about $750 billion in 1982 dollars. Revenue to meet these needs is projected to be about $460 billion resulting in a revenue shortfall of $290 billion.
>
> For the country as a whole, infrastructure needs for the four categories addressed in this study are estimated to be $1,160 billion in 1982 dollars. Revenue to meet these needs is projected to be $710 billion leaving a financing gap of $450 billion.
>
> Individual infrastructure components (e.g., water, sewer, etc.) illustrate the greatest regional variation.
>
> The greatest regional per capita infrastructure needs are projected for the Midwest. The region forecasting the smallest total requirements is the West. The Northeast, South and South-Central project total needs of similar magnitudes. All regions project future needs that are in excess of historical expenditure levels.
>
> All regions expect revenue to be insufficient to meet future infrastructure demands. Annual per capita revenue shortfalls range from $82 to $176 for funding highways, other transportation, water and sewerage systems.
>
> The single most dominant need across the country is highways and bridges. Total capital needs for this infrastructure component for the 23 states were estimated to be $466 billion, or 62 percent of the combined needs for highways, other transportation, water and sewerage systems. Assuming the same per capita relationship holds for other states throughout the country, total highway needs are projected to be $720 billion over the 1983 to 2000 period in 1982 dollars.
>
> On a regional basis, the greatest highway needs are projected for the Midwest. Annual per capita needs in the Midwest are projected to be $257, or 281 percent more than recent levels of capital outlay for highways.
>
> Total sewerage treatment needs are projected to be $106 billion in the 23 states, or $163 billion nationally in 1982 dollars. The greatest needs are projected for the Northeast and Midwest. The per capita requirements in these two regions are substantially larger than their recent expenditure levels and about triple the needs of the South and South-Central.

Water needs are projected to be $62 billion in the states under study, or $96 billion nationally in 1982 dollars. Water supply is predominantly a concern of the South-Central and West Regions where per capita needs are projected to be $44 and $31 respectively. Protecting supplies and renewing aging distribution networks are major concerns of the Northeast and Midwest.

Other transportation (i.e., ports, airports, railroads, mass transit) is a vital infrastructure component, but one in which the private sector has traditionally played a major role. Projected other transportation needs varied greatly from $3 per capita in the South-Central to $65 per capita in the Northeast. This variation is largely attributable to the relative importance to the various states and regions of "other transportation."

Chapter 1. INTRODUCTION

In the past several years, a new word—infrastructure—has entered the political vocabulary, reflecting a growing concern over the adequacy of the nation's public capital plant. The word infrastructure is a term that describes the basic network of facilities that drives our economy: our transportation, water and waste water systems. This report examines those aspects of infrastructure where the public sector has responsibility; it looks at the nation's transportation networks and its systems of water supply and sewage disposal.

The adequacy of the nation's infrastructure has come to be perceived as a problem due to declining levels of real capital investment which has resulted in the deteriorating condition of existing capital facilities. The fear is that if these patterns are not reversed, there will be a heavy toll in foregone economic growth. And at the same time, given high interest rates, projected federal deficits, and fiscal stress at the state and local level, investment levels are not likely to increase substantially unless public attention is drawn to the situation and remedial action is taken.

While a declining level of investment does not indicate existence of a problem per se, there is mounting evidence that the result has, in fact, been the deterioration of existing capital plant and an inability to deal with the demands of growth. The consequence in both instances is a reduction in the level of service provided. Some of the deterioration is evident to the casual observer. Pavements on the interstate highway system and on other major roads are cracked and rutted and no longer provide a smooth ride at high speeds. Other deterioration is less obvious—at least until a major failure in the functioning of a system results. Examples are all too frequent and have been well documented in the popular press. The water main failures in Boston and New York, water shortages in small Tennessee communities, the bursting of a dam in Colorado and depletion of ground water aquifers in New Mexico and Oklahoma all indicate some neglect of the public responsibility to maintain capital facilities. Problems of growth communities are sometimes less dramatic, but nonetheless real. Development moratoria may be imposed as existing wastewater facilities, designed for a smaller population, strain under the load. Long freight trains carrying loads of coal may split a town in two for hours at a time, denying residents access to businesses, hospitals or schools.

Even though the exact dimensions of the infrastructure problem are still unknown, it is clear that the problem is national in scope. Some type of difficulty seems to exist in most areas of the country. In older industrialized areas often the greatest difficulty is posed by aging facilities that need substantial rehabilitation or replacement. Growth areas face a diminution in their quality of life unless existing infrastructure is expanded and modified to accommodate the needs of new residents and businesses. Most states and regions are familiar with both kinds of problems and need some level of investment to maintain existing facilities and increase their capacity.

The condition of our infrastructure would be a national concern even if problems of deterioration or disinvestment were not found in all states. The economies of the various regions and states are so interdependent that some negative impacts are observable if any part of the nation's basic infrastructure functions poorly. Inland coal miners have a stake in harbor and port development so they can expand their markets overseas. Manufacturers require decent roads, bridges and rail lines so they can maintain access to their raw materials and transport their finished products to market. Communities downstream who rely on surface waters for drinking are affected by decisions of upstream municipalities concerning wastewater treatment.

The delineation of the problem and the framing of a solution to the infrastructure problem is greatly complicated by the fact that all levels of government have some responsibility for public works. Local governments (including municipalities, counties and special districts) have the primary responsibility for the construction, upkeep and operation of transportation, water and sewer facilities. Which type of local government has responsibility and which type of financing is employed depends on state law and historical patterns of development. State governments have direct responsibility for parts of the highway system, but in most states, for most other categories of basic infrastructure, the state governments' role is that of regulation, coordination and financing. The federal government plays a crucial role in financing basic infrastructure and its regulations influence both patterns of investment and standards of service. In addition, the federal government has played a direct role in the construction of water supply and inland waterway projects.

Major changes in domestic policy have been adopted during the last several years. A priority of the current administration has been to reduce the federal presence by cutting budgets and reducing regulations. State and local government and the private sector are being called upon to assume greater responsibility. In light of these changes, some clarification of the federal role with respect to infrastructure development appeared desirable and, thus, motivated this study.

HISTORY OF PROJECT

At the request of the Joint Economic Committee of Congress (JEC), the Graduate School of Public Affairs at the University of Colorado at Denver (UCD) undertook a study to help clarify the dimensions of the current infrastructure problem and examine the federal government role. The study had two purposes. First, it was designed to provide Congress with first-time information on the magnitude of the projected investment gap—the difference between infrastructure needs and the revenues likely to be available from all levels of government. Second, it was designed to begin the process of defining relevant policy options for closing the gap. The study was to differ from past efforts in that it would cut across functional lines and provide an analysis of problems and opportunities in terms useful to general purpose government officials as opposed to functional specialists. It would also accumulate information from the bottom up—focusing on what states know about the condition of their infrastructure and needs for the future.

Since the feasibility of a "bottom-up" study was uncertain, the initial study design called for an examination of conditions in four states—Colorado, New Jersey, Indiana, and Texas. The states are geographically spread and were presumed to illustrate the range of problems which might exist. The state case studies were to be based on interviews with state and local government officials and a review of existing capital planning documents and needs assessments. The goal was to characterize the condition of existing infrastructure, estimate the amount of investment required through the year 2000 to meet needs, and determine likely levels of revenue which would be available to support investments in basic infrastructure. The Joint Economic Committee also asked the University of Colorado at Denver to undertake a review of the federal role and determine likely changes in that role as the administration's New Federalism policies are considered. The third component of the study was a review of policy options which might be appropriate given the dimensions of the infrastructure problem and the changing federal role.

As a result of widespread interest in the project, as well as the preliminary results of the first case studies, it was determined by the staff at UCD and the JEC that an expanded study, involving more states, was both feasible and desirable. It would allow a better characterization of the nature of the problem—its overall magnitude and the range of manifestations around the country. It would also provide a better indication of the level of knowledge and planning capacity that exists in state capitals. Congressman Henry S. Reuss, then chairman of the Joint Economic Committee, invited the governors of the remaining 46 states to join the study effort. In response Congressman Reuss' invitation, 19 additional states agreed to participate in the study.

Shortly thereafter, Mr. Reuss retired from the Congress and Congressman Lee H. Hamilton, vice chairman of the JEC, assumed the leadership role for the project. A National Infrastructure Advisory Committee consisting of federal, state and local government officials, scholars, and private sector leaders was convened to guide the study. (Members of this committee are listed at the front of the report.)

Researchers, based at local universities (if possible) were selected to collect data in the 19 states. (The participating states and rsearchers for all 23 states are also listed at the front of the report.) In recognition of the importance of the study and its budget constraints, participating universities waived normal overhead. In addition, many of the researchers contributed part of their time.

All researchers were instructed to work closely with the governor's office in their states so as to ensure a study that would be useful to state decision-makers. They were also requested to follow the model of the four initial case studies, providing information on past levels of investment and the condition of capital facilities. Most important, based on interviews with government officials and a review of existing data and planning documents, the researchers were to provide an estimate of required investment and likely available revenues through the year 2000. In this way, they could identify the investment financing gap facing their state. It was recognized and agreed by all participants that this was a "threshold" analysis, dependent on existing inventories and planning documents. While a certain massaging of the data was possible (to extend time frames, adjust for inflation, etc.), it was not feasible within the time frame and budget of the study for the researchers to develop an independent assessment of conditions or needs.

When conducting research using the comparative case study method, it is usually desirable to have all of the researchers adopt a uniform definition of need or methodology for projecting revenues. This was not judged feasible in this effort for several reasons. First, any assessment of need inherently reflects a set of values. It was not possible to establish a set of values or standards appropriate or applicable for use nationwide. Second, if the study team had been willing to specify a set of standards against which conditions could have been judged, there would not have been sufficient data available within each state for the researchers to have utilized those standards. Third, one of the objectives of the research was, in fact, to determine the values which predominated within each state, the level of information available and the methods commonly used to identify needs or project revenues. Some of the conceptual and methodological issues identified by the researchers in the course of the study are discussed in a latter chapter.

The staff at the University of Colorado at Denver was responsible for pooling the case study results. First, a profile of each state participating in the study was prepared. While for the most part, these profiles are a simple summary of case study findings, an effort was made to present materials in a way that facilitated comparison.

The estimate of needs and revenues were aggregated for the case-study states, which combined account for 64 percent of the nation's population. These totals were extrapolated to the nation assuming other states' needs and revenue expectations were the same on a per capita basis as the average for the studied states. The nationwide totals were contrasted with the results of other available studies of infrastructure conditions and needs. Infrastructure problems of the case-study states and their regions were then analyzed and compared using data on past investment levels as well as the projections developed in the case studies.

The National Infrastructure Advisory Committee had the final responsibility for reviewing the study's findings and, together with the staff, recommending to the Joint Economic Committee a series of policy changes that could move the nation toward a solution of its infrastructure problems. Their recommendations were based on a review of study findings and on analyses prepared by UCD staff of the current federal role regarding infrastructure and of potential policy changes.

Prior to the National Advisory Committee meeting, a series of four regional retreats were held in New Jersey, North Carolina, Ohio and Denver. Participants at these meetings included members of the research team, state and local government officials and staffs of the various regional organizations including the Coalition of Northeastern Governors (CONEG), the Northeast-Midwest Research Institute, the Southern Growth Policies Board and the Western Governor's Policy Office (WESTPO). Report findings and policy options were reviewed and analyzed from the perspective of the various regions. Recognition of the legitimate concerns of all areas of the country greatly facilitated the process of consensus building and aided the advisory committee in making its final recommendations.

STUDY OVERVIEW

Chapter 2 discusses methodological and conceptual issues relevant to the measurement of infrastructure needs and revenues. Only issues of a general nature are discussed; problems specific to functional categories are examined in the following chapter.

Chapter 3 looks at each of the basic infrastructure categories which are the focus of the study—highways and bridges; other transportation; water supply, distribution and treatment; and wastewater collection and treatment. For each functional area, the report identifies the physical components of infrastructure, factors affecting their performance and methodological issues arising in assessing needs. Finally investment requirements and likely available revenues are reported for the nation.

Chapter 4 includes the regional and state comparison. It examines for each region and state, historical spending levels, projected investment requirements and likely available revenues. To facilitate comparisons, aggregate totals are standardized by population.

Chapter 5 looks at the federal government's role in providing basic infrastructure, focusing on recent programmatic and policy changes. It identifies two basic roles. The federal government helps finance the construction, repair or rehabilitation of specific components of the public capital plant. Second, it sets standards which define "needs" and guides the type and method of construction.

Chapter 6 contains policy recommendations for dealing with the nation's infrastructure problem. Since the report was prepared at the behest of the Joint Economic Committee, it focuses on actions that can be taken at the federal level. Given that primary responsibility for infrastructure investment will and should remain at the state and local level, a more general review of policy options available to state and local officials is also included.

The profiles of the individual states on which the comparative analysis builds are included in Appendix A. The profiles include information on assignment of functions, planning procedures, local economic performance and conditions and needs in each functional area. The full texts of the individual state case studies are included in an appendix to the report.

A staff analysis of the National Infrastructure Fund can be found in Appendix B.

Chapter 2. ESTIMATING NEEDS AND REVENUES: METHODOLOGICAL AND CONCEPTUAL ISSUES

INTRODUCTION

The primary goal of this study is to estimate infrastructure needs and determine whether anticipated revenues will be sufficient to meet those needs. This chapter explores methodological and conceptual issues arising in the measurement of needs and revenues.

The concept of need is fraught with difficulty. Any measure of need, explicitly or implicitly, involves a series of choices. Many of these are value laden. The condition of existing facilities must be assessed and future patterns of growth and development projected. More difficult is the choice of standards regarding desired service levels. Projections of revenue involve equally difficult choices. Estimates of need or revenue are neither correct or incorrect; they are only more or less reasonable depending on decisions made in the process of measurement.

In a threshold study such as this, the case-study researchers were given great leeway in devising measures. They were asked to review available data and planning documents and to accept the value judgements and assumptions underlying the states' own estimates of needs and revenues. A full discussion of the various methodological and conceptual issues uncovered by this research will help states develop the capacity to make better and more consistent choices in the future.

THE CONCEPT OF NEED

Need can be defined in terms of the investment required to construct, reconstruct, rehabilitate or repair capital facilities so they may provide a desired level of service, given expected patterns of growth and development. An evaluation of need, therefore, requires a sense of applicable standards, a knowledge of existing facilities, a reliable projection of growth and development patterns and information on construction costs. These and related conceptual, methodological and data quality issues are discussed below.

Relevant Standards

Investment in capital facilities is necessary to insure the provision of some level of service, presumed to enhance the quality of life. Typically, a set of standards is specified to gauge the size and type of facility required to provide the desired level of service. While crucial to the specification of "needs" there is little agreement concerning "desired service levels" or the link between standards and those service levels.

The level of service desired is a matter of preference or value. Individuals' preferences vary and the political process generally determines which set of preferences shall prevail. That process will likely produce different outcomes depending on the area and level of jurisdiction making the decision.

Preferences Affected by Price

When assessing levels of investment required to provide service into the future, most researchers assume that preferences regarding service levels will remain unchanged. This assumption may not be reasonable, however, if the cost of achieving that level of service changes. Individuals determine how much they want of almost anything only after they know the price and can calculate how much of alternative goods and services they would have to forego. Individuals engage implicitly in an opportunity-costing exercise.

Prices may change over time either because production costs shift or because the method of financing public works changes. In the course of our case studies, the question of changing prices and the link with demand arose repeatedly. For example, the easiest and cheapest sources of water have often been developed. Additional supplies cost more per acre-foot. If forced to pay a higher price for water, individuals may take steps to reduce their overall consumption. This in turn influences required investment levels by water suppliers. Several state researchers noted that it was especially difficult to predict agricultural use of water since it is likely to fluctuate depending both on the source of water to be developed and the willingness of the federal government to continue to subsidize water development for irrigation purposes.

Since standards must ultimately be justified in terms of citizens' preferences, one would expect the various state needs assessments to have been compiled using a wide range of standards. To some extent this is the case. On the other hand, two factors pushed in the direction of uniformity. Needs assessments are typically done by professionals in the field who share certain norms. Very often these norms are the basis for evaluating existing deficiencies and determining needed improvements. Many assessments of highway needs referred, for example, to standards of the American Association of State Highway and Transportation Officials (AASHTO). A second factor driving towards uniformity in standards is the role played by the federal government. In those functional areas where it plays a strong financial or regulatory role, its standards may govern needs assessments. Even though EPA's water quality standards are controversial, all of the states accepted EPA's assessment of their needs. They did so because they are mandated by law to make the investments required to comply with EPA standards.

Constrained vs. Unconstrained Needs

Needs assessments can be arrayed along a continuum. At one extreme is a wish list; at the other extreme is a capital improvement program or capital budget which includes only those projects that can be realistically financed at a given point in time. The first is drawn up unmindful of real fiscal constraints while the latter may ignore real needs. Researchers were asked to present a needs assessment that falls in the middle of the continuum.

Finding a middle ground between a wish list and a fiscally constrained analysis of needs was often difficult. Researchers tried to look beyond existing capital budgets to broader capital improvement plans or needs assessments. This was especially important in states with a weak economy or tax and expenditure limitations. After all, the goal of the study was to compare states based on their needs rather than their resources and to ascertain the magnitude of the financing gap in the various states. To avoid a pie-in-the-sky estimate of investment requirements, researchers looked closely at available needs assessments, choosing whenever possible an estimate based on middle-level standards rather than high-level standards.

Inventory of Facilities

To estimate needs, knowledge of the condition of existing facilities is required. The existing infrastructure may currently be providing service below the level desired, in which case some investment may be required to deal with this backlog of needs.

Infrastructure that is adequate today may well be inadequate in a couple of years for several reasons. First, facilities deteriorate with age and use. To continue in service, a program of repair, rehabilitation and, in some instances, replacement is required. If an inventory of facilities is maintained in sufficient detail, then these "recurring" investments can be programmed over the life of a facility.

The inventory of existing facilities should also include information on capacity and existing levels of use. If there is unutilized capacity, some level of growth and development can be accommodated without an expansion of infrastructure. But if facilities are operating at or near capacity, communities may require substantial levels of capital investment to cope with growth.

In preparing the estimates of state needs, the researchers were not always able to distinguish "backlog," "recurring" and "growth-oriented" needs. Often a needs assessment would focus on existing facilities that currently fall below standard (backlog needs). The amount specified for investment, however, would be sufficient not simply to restore the facility but to expand, modify, or replace it if necessary to meet future levels of demand.

In some instances, needs assessments focus on backlog needs and fail to take into account the fact that other facilities will fall into the substandard category sometime in the future if not worked on in the interim. In these instances, estimates of need are understated.

In other cases, however, it is likely that estimates of need are overstated. For example, a state may have prepared a capital needs assessment covering a 10-year period. Often these assessments include a substantial amount to bring existing facilities up to standard. Ideally, the investment required to cope with this backlog would be subtracted before extrapolating the 10-year investment to the longer timeframe required in this study. Often, however, the backlog portion of the needs estimate is not separately identified so that it is not possible to make the desired adjustment.

Forecast of Growth and Development

A fully reliable estimate of investment needs requires a projection of growth and development patterns. The projection would look at changes in population and in economic activity by sector and location, since the implications for infrastructure investment will vary depending on where and how growth occurs. Some industries make heavier demands on infrastructure than others. Location is important because some local areas have infrastructure that can accommodate growth while others don't. A number of methodologies exist for making projections, but the results are highly uncertain if the forecast period is relatively long. Few states collect the data or have the planning capacity in place to use the more sophisticated projection methods.

Few of the needs estimates presented in this report took account of growth-related needs in a detailed or sophisticated fashion. The needs assessment for wastewater treatment facilities are probably most sophisticated in that they build on a 20-year projection of population by county which is in turn related to the character of existing infrastructure. Needed facilities are identified on a project basis. For other functions, adjustments for growth are usually ad hoc. They are often based on growth projections for the state as a whole, thereby ignoring the differential capacities of local areas to absorb growth. Also, a linear relationship between population growth and investment requirements is sometimes assumed.

Estimating Costs

To complete the estimate of investment needs, the researchers must make some assumptions regarding the cost of constructing, rehabilitating or repairing the desired capital facilities. If all work were to be done in the current year, there would be little difficulty in estimating costs. But the planning horizon for this study is 18 years (1983–2000) and work on many of the identified projects would not begin for sometime. In general, researchers assumed that construction costs would remain constant in real terms and all estimates of required investment are presented in 1982 dollars. The estimates cover the costs of construction only; they do not include debt service costs even if it is customary for a jurisdiction to use debt financing for capital projects.

Capital vs. Operations and Maintenance

This study aimed at presenting an estimate of capital investment needs through the year 2000. Many researchers found it difficult to distinguish capital investments from operations and maintenance (O & M) expenditures. Some items which are included in capital budgets in one state are in the operating budget of another.

Even if a common definitional framework were adopted, the interrelationships between the two types of expenditures make it difficult to present estimates of needed investments that are comparable from state to state. A state's capital investment needs are in part determined by its level of commitment to operations and maintenance. If O & M expenditures are relatively low (deferred maintenance, capital needs are likely to be high. A lack of adequate maintenance funds will hasten the deterioration of highway pavement, thereby affecting the timing and overall amount of investment required for reconstruction. The same is true for airport runway pavements. Improper operation of sewage treatment facilities will reduce levels of treatment capacity and may negate the value of past investments for innovative design.

ESTIMATING LIKELY AVAILABLE REVENUES

Infrastructure should only be viewed as a problem if projected investment needs exceed likely available revenues. If that is the case, a serious choice confronts the nation; it must either increase its level of financial commitment for that purpose or it must revise downward its standards and expectations regarding service levels.

Researchers in each case-study state were asked to provide an estimate of revenues likely to be available to support infrastructure investment. This task proved difficult, indeed, since funding for infrastructure will depend on a series of political decisions to be made in each year of the coming decades by elected officials at all levels of government. It is not simply a matter of forecasting revenue yields given an existing set of laws and alternative economic scenarios, for only occasionally is a revenue source fully dedicated to infrastructure financing. Rather, the researchers must determine what portion of total revenue collections will be allocated to capital investment for basic infrastructure. The share of budgets devoted to that purpose in the past is not so stable as to provide a reliable indication of governments' future decisions.

Very few states engage in long term revenue forecasting so the researchers were forced to develop their own estimates. In all instances, they started by identifying current patterns of funding for each category of infrastructure. They noted, in a qualitative way, factors likely to cause shifts in future levels of funding. For example, if statutory or constitutional limits exist on tax rates, levies, spending or debt, an effort was made to assess their likely impact on capital budgets. Where federal grants play an important role, researchers assessed the likelihood of continued funding by examining federal law, the type of projects needed within the state and their eligibility for federal assistance and the state's ability to raise matching funds.

The qualitative assessment of factors affecting revenue flows was accompanied by the simple and crude estimate of revenues. In most cases, researchers assumed that states would be able to spend the same amount as currently budgeted for capital construction, rehabilitation, etc. Occasionally projections of future revenues (including authorized bond issues) incorporated in short term capital plans were the basis of the long term revenue projections reported in the case study. In some instances, figures were adjusted to take into account expected population or income growth, but this was the exception rather than the rule. In a couple of cases, revenues were projected using linear estimating techniques.

THE CONCEPT OF FISCAL CAPACITY

A revenue estimate is conceptually different than a measure of fiscal capacity. Revenue estimates are generally based on the existing financing system and they accept the level of effort on behalf of infrastructure as given. Fiscal capacity refers to the strength of the underlying economy on which all revenue collections inevitably rest. A state may have a relatively strong economy (and hence high capacity) but a low level of projected revenues if it has low tax rates and user charges or devotes a relatively small share of total revenues to basic infrastructure.

Even though expected revenues may fall short of investment requirements in a state, in may be wrong to conclude that it has a more serious problem than a state with a smaller revenue gap. One researcher noted that expected revenues were low in his state, but that it had the capacity to cope with its infrastructure problem if only it had the will to do so. In other states, however, there may not be excess capacity; even small revenue gaps may be difficult to close if the economy is weak and tax rates and debt levels are already high.

While the concept of fiscal capacity is relatively clear, measurement is difficult and subject to controversy. Some analysts prefer to measure state capacity in terms of per capita income. Others suggest that per capita income is an appropriate measure of residents' well-being but not of the ability of state and local governments to raise revenues. The Advisory Commission on Intergovernmental Relations had developed an alternative measure using a "Representative Tax System" (RTS) methodology. All of the tax bases typically used by state and local governments are identified and a national average tax rate is applied to a measure of those bases within each state. The RTS measure has also been criticized on several grounds.

A measure of capacity to deal with infrastructure is even more difficult to develop than a general measure of fiscal capacity since it may be appropriate to introduce a time dimension. Both the per capita income and RTS measures focus on capacity at the current time. Infrastructure needs, however, have been defined in terms of investments required through the year 2000. Furthermore, by their nature, capital investments yield benefits over a long period. Hence, it would be desirable to look at fiscal capacity over an equivalent time period. If a local economy is growing, it will be better able to support needed investments than would be suggested by a measure reflecting today's capacity.

Clearly given the need to allocate public resources in a fair and efficient manner, more work is needed on issues related to fiscal capacity. Since the various methods of measurement show different jurisdictions having high or low capacity, the methodological debate has policy ramifications. It was beyond the scope of this study to determine the best method for measuring fiscal capacity.

Chapter 3. FUNCTIONAL ANALYSIS

Three broad categories of state and local capital needs are analyzed in this study: transportation; wastewater collection and treatment; and water supply, storage and distribution. They were selected for analysis because their effective functioning is so crucial to the nation's economic growth and development.

Jointly, these categories of basic infrastructure have been responsible for approximately one-half of all capital outlays by state and local governments over the last decade.

Each category of infrastructure is discussed below. A brief description or analysis of the following is provided:

1. Physical components of the system.
2. Organizational framework for service provision.
3. Past investment levels.
4. Specific problems affecting the system.

A national estimate of investment requirements and anticipated revenues is provided based on the 23 case studies[1] undertaken for this project. The nationwide estimates were derived by calculating an average per capita figure across all the states for which information was available and extrapolating to the nation assuming the experience of other states was comparable to that of the study states on a per capita basis.

To place this study's findings regarding capital needs in perspective, the estimate of required investments is compared to other available needs assessments. The estimates of needs are also contrasted with past levels of investment and anticipated revenue figures to determine the magnitude of the increase in financial commitments required to respond to investment needs. Each category also includes a section discussing some of the methodological and conceptual issues confronted by researchers in producing the estimates of need and revenues.

TRANSPORTATION: HIGHWAYS AND BRIDGES

Highways and bridges are a major component of the nation's transportation system, the effective functioning of which is crucial to economic performance. Almost the entire road system is built and operated by state and local governments; however, the federal government has played a crucial role in financing the construction of roads. In more recent years, federal funds have also been available for reconstruction and rehabilitation efforts.

After many years of rapid growth in capital spending for highways, the pattern shifted around 1970. Total capital spending continued to increase but at a slower pace than the cost of construction. Hence, expenditures measured in real dollars declined rather steeply through the seventies. This is true for the nation as a whole and in almost all of the case study states.

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[1] The summary of each case study state is included in appendix A. Each case study will be published by the Joint Economic Committee of the Congress.

There are two major reasons for the decline in capital spending:

(1) *Completion of the interstate system.*—Capital construction was very high as the nation implemented its plan for a national system of major interstate highways. As these and other major roads were put in place, budgets shifted towards maintenance and operations.

(2) *Financing via inelastic gasoline taxes.*—The more important explanation for the relative decline in capital spending for highways probably lies with the fact that most states and the federal government rely heavily on the gasoline tax to finance highway improvements. In most cases, the tax is levied on a pennies-per-gallon basis. In the fifties and sixties, as highway travel and gasoline consumption increased, this earmarked revenue source provided sufficient funds. After the Arab oil embargo in 1973 and the rise in gasoline prices, Americans altered their travel patterns, shifted to more fuel efficient cars and moderated their gasoline consumption. Since tax collections were tied to consumption rather than price, growth was sluggish over the decade.

The road system could tolerate some decline in capital spending since much of the pavement was new and in good condition. Even so, the downward trend has taken its toll in pavement conditions. Although mileage in "poor" condition remained relatively low at the beginning of this decade, the percent of miles in "good" condition has decreased substantially.

Payment deterioration accelerates as a roadway increases in age and approaches the end of its design life. Hence there is a need for increased investment to avoid significant deterioration in the level of service provided by existing infrastructure. If no capital investment were to be made to the existing highway system, the Department of Transportation estimates that between 70 and 90 percent of road mileage (depending on road classification and traffic level assumptions) would deteriorate to a "poor" condition within 15 years and require replacement.[2]

Determining Investment Needs: The National Perspective

Based on the condition of a national sample of road segments and alternative assumptions about vehicular use, the U.S. Department of Transportation (DOT) provides estimates of investments required on the nation's "major" roads—the interstate, arterial and collector road systems. These roads comprise approximately 1.2 million miles or 30 percent of the nation's roads but carry approximately 80 percent of the traffic.

In its 1981 report to Congress, the DOT offered two approaches to the estimate of need:

(1) *Full needs.*—Applying "minimum condition standards" which embody "engineering, performance and safety perspec-

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[2] U.S. House of Representatives, Committee on Public Works and Transportation, "The Status of the Nation's Highways: Conditions and Performance" Report of the Secretary of Transportation to the United States Congress (Washington D.C.: U.S. Government Printing Office, 1981).

tives," it concluded an investment of $337 billion to $363 billion (1980 dollars) would be required over 15 years to remove all deficiencies. This translates into an annual investment of $22.5 to $24.2 billion.

(2) *Maintenance of conditions.*—In order to maintain conditions (e.g., pavement quality, levels of congestion) as they existed in 1978, an investment of $225 to $249 billion would be required over 15 years ($15 to 16.6 billion annually).

These estimates were undertaken assuming a continued growth in vehicle miles of traffic (VMT), from 1.5 billion VMT in 1977 to between 1.7 and 3.0 billion in 2000. It assumes that deficiencies requiring increased capacity must be met through improvements to the existing system only (no new roads) and that physical improvements will be made to urban systems only where states have indicated that right-of-way considerations allow an increase in lanes. The improvements range from simple resurfacing to major reconstruction which may entail different geometrics (lane width, shoulder size, allowable grade, etc.).

Determining Investment Needs: State Perspective

Most states were able to provide some assessment of the condition of "major" roads within their states. The assessments of condition should be more or less comparable since most were based on the highway performance information system set up by the U.S. Department of Transportation and used in the National Needs Assessment. Few could provide assessments of conditions for local roads.

The scope and method of needs assessment varied by state. Some of methodological issues that surfaced which affect comparability are noted below.

1. *Jurisdictional responsibility.* Many states reported investment needs on state-maintained systems only. The percentage of the total system which is a state responsibility varies considerably by state. Texas, for example, is responsible for a little more than 25 percent of all road mileage, while the North Caroline state system covers 85 percent. In all instances, the state system includes the larger roads carrying the most traffic, built to the highest design standards and involving the highest capital costs.

When estimates of local road investments are included, the basis for the estimate is usually less sophisticated and less inclusive than for state roads. While the state road estimate may take account of condition, traffic use and engineering assessments of the cost of correcting various deficiencies, local road estimates tend to be based on incomplete data and simple rules of thumb. In some states, survey-based short-term estimates of capital requirements were available. These were then extrapolated to the study time frame, usually with no allowance for increases in traffic. In other states, it was simply assumed that all paved local roads would require resurfacing sometime during the study period and an average per mile cost for that task was assumed. Neither method takes explicit account of likely patterns of growth and development within a state. This is a shortcoming in that major increases in mileage are most likely to be realized in local road systems.

2. *Application of standards*. Spurred by the crisis in highway funding, several states have undertaken long-term needs assessments in the highway area. While some reported using standards of the American Association of State Highway and Transportation Officials as the basis of their estimate, others estimated investment requirements based on lower, and in the view of state planners, more realistic goals. For example, a Montana study suggested a modification of design standards capable of providing "reasonable levels of service" and reported an investment requirement less than half of that estimated to meet "full design" standards. A gubernatorial commission in North Carolina suggested a number of options for dealing with their road system. None, however, included major construction of new roads. The most ambitious of the plans considered called for the upgrading of existing roads to a high level of standards. At the low end, an option costing less than 40 percent of the first was suggested which would maintain existing roads but allowed no upgrading despite expected growth in the state.

3. *Allowance for growth or change.* While this issue has already been alluded to, it is important to note that few states made explicit their assumptions regarding growth. Some states took account of the need to construct new roads, others were silent on the subject and yet others noted that their assessments pertained to existing road networks only.

The estimates of bridge investment needs, in almost all cases, were based on the assessment of condition of the existing inventory. Few states took account of the fact that additional bridges, now structurally sound or functionally adequate, would fall into disrepair or would be inadequate given future traffic flows. Estimates pertaining to existing roads, at least on the state systems, were more likely to distinguish "backlog" from future or recurring needs, although the factors taken into consideration in the latter two categories were often unclear.

4. *Consideration given to revenue constraints.* When no needs assessments were available, investment requirements were extrapolated based on short-term capital improvement programs. These programs typically include projects which have already been screened for political and financial feasibility. Since such plans are generally prepared subject to severe fiscal constraints, an extrapolation of investment requirements in the long run is not comparable to one based on a long-term needs assessment, even if the latter is based on a "scaled-down" set of standards. The revenue constraint implicit in the reduction of standards is usually less severe than that imposed in the development of actual capital improvement programs.

State-Based Estimates of Investment Needs Through the Year 2000

All 23 states participating in the study provided some estimate of investment required for highways and bridges through 2000. Their needs total $466.5 billion, or $25.9 billion on an annual basis. If the needs of our study states are similar to those of other states as measured on a per capita basis, then national investment needs total $720.2 billion through 2000 or $40.0 billion annually. This state-based needs assessment is substantially larger than DOT's, presumably because it takes some account of construction requirements on local roads.

In all but one study state, projected annual investment needs exceed recent levels of capital expenditure by significant percentages. In 12 of 23 states, expenditure levels would have to more than double to meet investment needs. Given that local roads are often included in historic capital investment figures and are frequently missing from the state needs estimate, the increase in commitment required is likely to be even greater.

Needs Relative to Projected Revenues

An alternative way of assessing whether investment needs can be dealt with is to assess them in relation to projected revenues. Given recent efforts to enhance revenues for this purpose, the projected gap should appear smaller than when the reference point is past expenditure levels.

In 1982, the federal government acted to increase the federal gasoline tax by five cents per gallon, effective April 1, 1983. It also increased road use charges levied on trucks. A number of states had taken similar steps before the federal government acted. Indeed, 1981 was sometimes referred to as the year of the gasoline tax as 26 states raised rates in that year and 13 raised motor vehicle registration or license fees.[3] At least 12 additional states have passed tax increases since 1981, many to raise funds needed to match the extra federal aid authorized by the Surface Transportation Act of 1982.[4]

While the revenue projections provided in the case studies were rarely based on a sophisticated projection of gasoline consumption and current tax laws, they nevertheless captured some of the effects of recent legislative actions affecting tax rates. Most researchers started with their state's federal aid apportionment or likely level of obligation (noting that historically, obligations fell short of apportionments due to congressional limits on spending) and assumed no change in the out years of the projection period. State and local contributions were frequently extrapolated based on current year budgets, which reflected recent increases in taxes and fees. Some states, however, used prior year expenditures as the basis for extrapolating future revenues and in these instances, revenue projections are probably too low and gaps are probably overstated. Revenue gaps may also be overstated in some states in that revenue projections often did not take account of projected increases in state population or economic activity.

Researchers in the 23 case-study states projected that $294.9 billion in revenues would be available to support capital investments for highways and bridges through 2000. Extrapolating to the nation, a total of $455.3 billion is estimated to be available. This figure is $264.9 billion less than projected investment needs. Put another way, projected revenues equal 63 percent of the investment requirement.

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[3] Steven D. Gold, "Recent Developments in State Finances", pp. 1–30 in National Tax Journal, Vol. XXXVI, No. 1, March 1983.

[4] "Preliminary Report: America's State-by-State Infrastructure Needs," Constructor, June 1983.

TABLE 3.1.—HIGHWAY AND BRIDGE INVESTMENT REQUIREMENTS, PROJECTED REVENUES AND FINANCING GAP, 1983–2000

[In billions of 1982 dollars]

	Needs	Revenues	Gap
Case-study States	$466.5	$294.9	$171.6
National total (extrapolated)	720.2	455.3	264.9

Among the 23 study states, the size of the gap varied greatly both in absolute terms and as a percent of projected needs. The largest gap is projected for Ohio. Five states estimate revenues to be less the 50 percent of their projected investment requirement.

OTHER TRANSPORTATION

This category is a catch-all including several different types of infrastructure. The largest element is public surface transportation. But depending on the state, air, rail and water transportation systems may also be included. There is also great variability among the case-study states in the projection of needs or revenues. Several circumstances may account either for the omission of a needs or revenue projection for a given type of infrastructure or for the great variation in values.

1. The responsibility for service provision belongs to local governments; state governments may play little or no role. When this is the case, too little data may have been available for the researcher to estimate needs. In some instances where states provide a small amount of financial assistance or are contemplating doing so, needs estimate may be available, but the only information on revenues may be estimates of likely levels of state support.

2. The responsibility for service provision rests heavily with the private sector and there may be little need for of history of government investment to maintain adequate service levels. Private sector involvement was most notable in the case of railroads and water transportation. It was often significant in air transportation as well.

3. A state simply may not rely on a particular mode of transportation. Water transportation is primarily a concern of coastal states (although inland state economies may require good access to port facilities). Mass transit systems generally exist only in urban areas. Levels of dependence on these systems vary tremendously among cities.

Public surface transportation. Included in this category are the various mass transportation systems operated within urban areas. For the most part, these systems provide scheduled bus service. Capital investments include bus repair and replacement, bus barns, maintenance facilities, bus shelters and park-and-ride lot. In some areas, bus systems are supplemented by light rail or subway systems. Many of these systems are quite old and substantial investment is required to rehabilitate or replace moving stock, improve track, tunnels, ventilation systems and signaling equipment. In addition to the investment needs associated with existing systems, several cities in the country are interested in constructing entirely new rail systems.

In its recent assessment of national infrastructure needs, the Congressional Budget Office (CBO) indicated that an annual investment of between $3.6 and $5.5 billion might be required for public surface transportation.[5] If this assessment of need is extrapolated to the 18-year time frame of this study, then the total investment required for mass transit would be between $65 and $99 billion.[6] The high estimate includes $3.3 billion to repair, modernize or replace existing facilities and is based on an Urban Mass Transportation Administration (UMTA) study of "10-year Federal/State/Local Investment Requirements." It also includes an estimate of $2.2 billion a year for new and expanded rail transit systems. This estimate is attributed to the American Public Transit Association, an organization of local transit system operators. The low estimate of annual investment needs was put together by the CBO and includes $2.9 billion for existing systems and $700 million for new and expanding systems.

Of the $3.3 billion required annually for existing facilities, UMTA estimates two-thirds is required by existing rail systems largely to cope with a backlog of needs. Two cities alone, New York and Chicago, account for half of total rail system rehabilitation needs.

The case studies find that in most transit systems, capital stock is in relatively good condition. This finding holds for most bus systems and for the newer rail systems. The estimates of investment needs are based primarily on the costs of bus replacement. Since buses are likely to have a service life of 12–15 years, by the year 2000 the entire fleet may have to be replaced. Few states noted a need for bus fleet expansion. Some called for increased capacity in the form of new light rail systems.

The exceptions to the finding that capital stock is in good condition are found in the older rail-oriented systems. All of these systems have a large capital stock, much of it aged and in deteriorating condition. Backlog needs are high due in large part to a pattern of deferred maintenance. The Massachusetts case study highlights the contribution of maintenance practice to the development of its infrastructure problem. "The cost of maintaining the rapid transit system derives from no specific long term program and maintenance is carried out largely on a day-to-day emergency management basis." [7]

The New York case study identified the biggest mass transit investment requirements in the study. Over $37 billion should be spent on New York City's system alone.[8] New York's subway system is unique in size and role. It consists of over 700 miles of track, 500 stations, 6,500 cars and it serves between 3.5 and 5.0 million passengers daily. For a number of years, the city has failed to make the investments required to maintain the system. Service has deteriorated and this is having an impact on ridership. A lot of "catch-up" spending is required to deal with backlog needs. For example, by the year 2000, nearly 4,500 subway cars will need replacement based either on age (exceeding 35 years) or performance.

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[5] U.S. Congressional Budget Office "Public Works Infrastructure: Policy Considerations for the 1980s" (April 1983) pp. 46–47.

[6] This extrapolation is done with some risk since the total includes a significant amount of backlog needs.

[7] Karen R. Polenske et al., "An Assessment of Public Infrastructure in Massachusetts," p. 31.

[8] Rae Zimmerman. "Infrastructure Needs Analysis for New York States."

Almost all of the case studies note that operating deficits pose a more serious problem for transit systems than capital investment; indeed, the estimate of capital needs may be overstated because some systems may disband operations if increased local support is not forthcoming to replace federal grants for operating assistance which will be reduced in coming years. It is also possible that some case studies include an estimate of the likely support required to cover expected operating deficits in their capital investment figures. To the extent this is true, investment needs would be further overstated.

Airports. The nation's air transportation system consists of 780 commercial airports, served by scheduled airlines or by commuter and air taxi operations, and 2,379 general aviation airports.[9] Airports are generally run by local jurisdictions. State government involvement is minimal. The federal government is responsible for the air traffic control system and assists in the financing of capital improvements at airports.

The Federal Aviation Administration (FAA) prepares an airport system plan on a periodic basis. A plan covering the period 1980–1989 identified $12.7 billion in investment needs; if annualized and extrapolated to an 18-year time frame, almost $23 billion in investments would be required in airport development. The FAA plan only includes projects eligible for federal assistance and hence excludes such things as terminals, access roads, etc. Of the $12.7 billion required through 1989, approximately two-thirds is necessary to increase capacity either by improving existing airports (e.g. extending runways to handle larger plans, adding runways and gates, etc.) or building new airports.[10]

The case study researchers were generally able to locate information on capital needs, but found it difficult to project revenues. In many states revenue projections were either incomplete or missing. A consistent finding of the state researchers was that revenue shortfalls were most likely among the smaller airports serving general aviation.

Railroads. Railroads are generally owned and operated privately. A number of states, however, indicated that public investments were required to forestall line abandonments. With public investment in track rehabilitation, some of the lines crucial to the economies of smaller communities could be made viable and hence, would be maintained. Almost all states which indicated existence of an investment need expected to have difficulty with financing. Efforts in the past have been funded through federal grants which are no longer available.

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[9] U.S. Congressional Budget Office "Public Works Infrastructure: Policy Considerations for the 1980's." (April 1983) pp. 103–105.

[10] U.S. Department of Transportation, Federal Aviation, Administration, "National Airport System Plan, Revised Statistics 1980–1989."

Water transportation. Several states noted investment requirements to maintain water transportation facilities. In states like Washington and Maine, the investments were required to rehabilitate or replace ferries and docking facilities. Other states noted the need for improved port facilities. Investments may be required to maintain or expand publicly owned terminals, wharves, berths or storage facilities. A need for dredging was sometimes noted, although the costs were not included in the needs estimates because channel improvements have typically been financed by the federal government with no state or local government involvement.

Projected needs and likely revenues. The case-study states report $115.2 billion in investment needs for "other transportation" infrastructure. If this finding is extrapolated to the nation, assuming needs in other states are comparable on a per capital basis to the 23 study states, then the nation must invest $177.8 billion before 2000. This extrapolation method, used throughout the study, has some drawbacks when applied to this functional area. It probably results in an overstatement of needs since New York and several other states known to have unusually high transit needs are included among the case-study states. It may be wrong, therefore, to assume that the remainder of the nation has a per capita need comparable to that found in our case-study states.

Nationwide, $89.7 billion is likely to be available to finance investments (extrapolated from a case-study state total of $58.1 billion). Revenues would have to double to meet all identified investment needs.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

Water supply and distribution systems generally consist of several elements.

1. *Source.* Water may be drawn from surface or ground water sources. The infrastructure includes facilities or projects related to well site or surface water development and watershed protection.
2. *Storage.* Frequently some kind of storage facility is required if surface flows vary over time in quality or quantity or to provide pressure to the water distribution system. Infrastructure costs include site acquisition and development; construction, repair or rehabilitation of impoundments; construction or repair of reservoirs standpipes or elevated tanks.
3. *Treatment.* Depending on the quality of the water entering the system, treatment by chemical addition, flocculation, filtration or softening may be required.
4. *Transmission/Distribution.* The infrastructure may consist of a system of aquaducts, pipes, valves, pumping stations, meters and hydrants designed to bring the water from the initial source of supply to the storage and/or treatment facility and then onto the final user.

The organizational system for developing and delivering water is complex in character and varies by state. In all states, diverse types of local government have responsibility for water supply. Many states also rely on private utility companies and/or rural cooperatives. Among public sector providers, water may be provided by municipalities or several types of special districts. Also in all states, some areas fall outside the jurisdiction of organized water supply systems; instead, individuals develop their own on-site surface or ground water supplies. These individual systems generally work until density of development threatens the quality or quantity of supply, either for domestic use or fire fighting purposes.

The case studies offer several examples of the diversity of organizational providers. Massachusetts, for example, relies on 363 central water supply systems serving 293 cities and towns. Of these, 68 are private companies, 78 are fire and water districts and 217 are municipal water departments. Massachusetts also highlights another interesting aspect of organization. The task of developing water supplies has often been taken on by a large organization serving a broad region. That organization either delivers water directly or sells it wholesale to smaller public or private water companies for distribution to final users. Regional organizations have been especially important when water supplies are located at some distance from the area to be served and when large storage and transmission systems are required. The Boston metropolitan area receives the bulk of its supplies from the Metropolitan District Commission (MDC), a regional organization established many years ago by the state legislature. The MDC's big project involved construction of the Quabbin Reservoir, 65 miles west of the Boston metropolitan area.

New Jersey notes a high level of reliance on private water companies. Of 619 purveyors, 310 are private companies. In addition to these investor-owned companies, the state's Water Supply Master Plan identifies four additonal categories of water purveyors—municipally operated systems, regional water commissions, water authorities and state operated utilities. The New Jersey case study also notes a great divergence in the size of water supply companies. The densely settled northeastern part of the state is served by a few relatively large systems while the south and west are served by a large number of small purveyors, many of them private companies established by a developer or builder to serve a single subdivision.

While direct responsibility for water supply is almost always a responsibility of a local government or private company, state governments become involved for a variety of reasons. Some state governments' involvement may be episodic as they are called upon to deal with specific needs for interbasin transfers of water and right-of-way issues. Other state governments, particularly in the more arid areas, have a more regular involvement as master planners and/or adjudicators of water rights disputes. State governments also tend to be involved because river basins cross state boundaries and they are called upon as signatories to interstate compacts.

The federal government through the Bureau of Reclamation has had a long-standing involvement in the development of water sources in the arid western region where water was viewed as a key to economic development. The Army Corps of Engineers undertakes water projects nationwide. While many of these developments are designed primarily to improve water transportation or cope with flooding problems, some contribute to the development of water supplies for municipal, industrial or agricultural use. The Farmers Home Administration has helped finance small rural water systems nationwide. While some community or regional development funds have been available for use by urban water suppliers, the federal role in financing either supply or distribution systems for cities has been minimal. The federal government's primary impact in those settings has come through the Safe Drinking Water Act of 1974 which mandates inspection of public water supplies and treatment if any of several contaminants are discovered.

Types of Problems

Several types of water problems exist in the nation. Some are more prevalent in one part of the country than another.[11]

1. *Deterioration of old water distribution systems in Urban areas.* A Massachusetts Special Legislative Commission identified the problem of old water pipes as the "single greatest need" of older cities and towns. While old pipes are not necessarily bad, many need in-place cleaning and lining and others should be replaced. Old pipes frequently leak which can result in strained supplies, inadequate pressure for effective fire protection and degradation of water quality. Massachusetts has responded by passing a bond issue to finance programs of leak detection and system rehabilitation. All of the case study states which had any number of older urban settlements noted some kind of rehabilitation need for water distribution networks.

2. *Inadequate sources of supply and storage or poor interconnection among urban systems.* Several states reported that during extended dry spells, municipal supply problems can be expected to result. Tennessee, for example, relies on a large number of small systems which draw supplies from small surface streams or shallow ground wells. During the 1980 drought, many systems without storage capacity were short on water. In some communities, water had to be trucked in by National Guard units.

New Jersey also noted supply problems during recent droughts. In its master plan, the state identified as critcal area of need "linkages between and among key sectors of the water supply system . . . to allow for redistribution from water surplus to deficit areas" as well as "drought and emergency response plans."[12]

A number of cities in all states are likely to take steps to deal with increases in expected demand. In some areas, correction of leakage and encouragement of conservation may be sufficient to meet new demands. In other areas, new sources of supply and storage will also have to be pursued.

3. *Overdrafting or "mining" of underground aquifers.* In several areas dependent on underground water supplies, water is being withdrawn at a faster rate than it can be replenished. In the short run, this may mean deeper wells and a higher cost of extraction. Over the long run, if corrective actions are not taken, water quality will diminish and supplies will run out. In some instances, the only alternative is the development of alternative supplies. Sometimes,

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[11] This classification of need is based primarily on the case studies completed as part of this research project. It builds, however, on the conceptualization of water problems found in Laurence Pringle, "Water: The Next Great Resource Battle", (New York: Macmillan Publishing Company, 1982).

[12] Robert W. Lake, "New Jersey's Infrastructure Needs: A Case Study," p. 57.

however, watershed protection measures can be taken that enhance the rate of replenishment.

Depletion of ground water was listed as a concern by several states. One state with a major problem is Oklahoma. The problem is described as follows:

> Ground water presently provides 61 percent of total water use . . . serving about 300 communities. In addition, ground water supplies approximately 80 percent of the water for irrigation . . . the 14 underground reservoirs have a combined overdraft—the water in the aquifers is being pumped out and used at a rate faster than the ability of natural resources to replenish the supply . . . (The) chief of planning of the Water Resources Board has commented, "in some areas where they have been pumping water for irrigation, they will go dry in the next 10 to 15 years."
>
> A prime source of ground water is the Ogallala Aquifer . . . In 1977, the water stored in the aquifer was estimated at 59.9 million acre feet. If usage . . . continues at the present rate, estimated water storage by . . . 2020 will be 29 million acre feet. Although considerable water remains in the aquifer, the economic costs of pumping it could soon make its use prohibitive.
>
> Overdrafting of the Ogallala is of concern to many Oklahomans and the spectre of a return to dry-land farming becomes more real as the ground water resource is depleted. Agriculture is big business in Oklahoma . . . Irrigation using ground water has played an important role in increasing the productivity of Oklahoma's farmland . . .[13]

The depletion of the Ogallala Aquifer affects other states as well. In New Mexico, 86,334 acres of land would "be converted from irrigated farming to dry farming or range due to depletion of the aquifer, with obvious great losses in productivity." [14]

4. *Development of additional water storage capacity to capture "entitlements," insure supplies needed for population growth and/or maintenance of agricultural economies in arid western areas.* Wherever there is significant seasonal or cyclical variability in precipitation, reservoirs are needed to capture high spring flows for release later in the year and to store water from year to year. Extensive distribution systems are also required to bring water to final users. For example, Colorado estimates that it depends on 2,000 reservoirs with a total capacity of 6.5 million acre feet and several thousand miles of canals and ditches.[15]

In the West, several factors drive the assessment of capital investment requirements—some stemming from organizational and political environments and others reflecting a forecast of continued high levels of economic growth and consequent increases in water usage. An indication of how these factors fit together is provided by several of the case studies. Surface waters are allocated among states by interstate compact, Supreme Court decisions and international treaty. In the Colorado River Basin, there is some uncertainty regarding these allocations, since it appears that the river's flow in a typical year falls short of the total amount allocated among the several states and Mexico. Hence several of the states which are party to the compact feel a "need" to develop their water entitlement for fear they will be the one to suffer the loss when the consequences of the over-allocation are realized. Governor Lamm of Colorado, for example, issued a warning in his State of the State message in 1982: "Unless we take steps to capture and protect all the water we are legally entitled to, we may find ourselves on the wrong side of a federal court decision that will deny us use of water that has heretofore been ours. We can wait no longer." [16]

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[13] Jean McDonald, Tim Adams, Steve Ballard, Tom James, "Oklahoma Infrastructure Analysis", Water Chapter, pp. 2-3.

[14] Lee B. Zink, "Public Infrastructure Needs, 1982-2000: New Mexico Case Study", p. 48.

[15] James Ohi, "Colorado's Public Infrastructure Needs and Capital Investment Planning and Budgeting Processes," p. 83.

More generally throughout the region, there is a concern over the cost associated with developing new water storage and diversion facilities. Such infrastructure development is viewed as necessary to allow for increases in municipal and industrial use, or at least to allow for such increases without threatening the agricultural economy. The threat stems from the fact that under western water law, water rights can be bought and sold on the free market and alternative users can afford to pay more than existing agricultural owners of water. Hence, without development of additional supplies, economic growth would force the reallocation of existing supplies away from agricultural uses.[17] This is viewed as undesirable inasmuch as agriculture diversifies the economy and is crucial to the maintenance of western lifestyle and values.

5. *Contamination of existing groundwater and surface supplies.* Several states report that a new water supply systems must be developed because existing groundwater systems are contaminated. Many also report the need for additional treatment facilities to insure public health.

6. *Rehabilitation of impoundment facilities to assure public safety.* Several states have noted that existing dams are structurally unsound and that in the event of failure, significant damage to life and property would likely occur. None of our study states could detail the cost of the repairs required but several noted the need for additional inspection of both public and private facilities, rehabilitation and repair of publicly owned facilities and enforcement to insure that remedial action is taken by private owners of unsafe facilities.

7. *Inadequate treatment facilities.* The Safe Drinking Water Act established standards regarding the quality of water and mandated inspection of all public water supply systems. In 1980, 97 percent of all community water systems met the standard for bacteria and 89 percent met turbity standards.[18] Within our case-study states, researchers noted that inspection records existed on water quality but that few state agencies had compiled their findings in a way that was helpful to an assessment of infrastructure needs. Several states noted communities having problems with chemical contaminants but no systematic information was available.

Water Needs: Case Study Results

Based on this study's finding, an investment of $96.2 billion is required to meet the nation's water needs through 2000. Revenues totaling $54.5 billion are anticipated to be available over the same period.

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[16] Colorado Forum, "The Upper Colorado River Basin and Colorado's Water Interests", 1982, p. 47.

[17] The threat of reallocation of supplies is noted in the Colorado, New Mexico and Texas case studies.

[18] Congressional Budget Office, "Public Works Infrastructure: Policy Considerations for the 1980's" (April 1983).

TABLE 3.2.—WATER SUPPLY, DISTRIBUTION AND TREATMENT—ESTIMATED NEEDS AND REVENUES, 1983–2000

[In billions of 1982 dollars]

	Investment required	Anticipated revenue	Likely shortfall
Case-study States	$62.3	$35.3	$27.0
Nationwide total (extrapolated)	96.2	54.5	41.6

Alternative Needs Estimates Compared

The estimate of the nation's water needs from this study are contrasted with other available estimates of needs in Table 3.3. Since the various studie~~s drawn~~ upon reported needs over differing time periods, the comparison is shown in terms of annual investment required.

This study projects that an annual investment of approximately $5.3 billion will be required to meet water needs. This directly corresponds to an estimate compiled in 1973 by the National Water Commission using a 50-year time frame. They concluded that $53.6 billion in 1972 dollars was needed for municipal and industrial water supply purposes and $52.4 billion for irrigation and drainage purposes. If the figures are annualized and translated into 1982 dollars, an annual investment figure of $5.0 billion results.

On the other hand, this study's estimate of investment needs falls substantially below one calculated by the President's Water Policy Task Force in 1980 for urban water systems. Based on 756 urban water systems, they concluded that an annual investment of $6.3 to $9.1 billion would be required to replace or rehabilitate existing systems and to accommodate growth. The Congressional Budget Office estimated that if the 756 systems on which the study was based were typical of all systems nationwide, then an investment of some $10–15 billion per year might be required. These figures do not include water developed for irrigation purposes. CBO suggests that the annual investment required for all multi-purpose dam projects is $2.9 billion. These dams serve several purposes including power generation, recreation, etc., but if it were assumed that the projects were for the sole purpose of irrigation, then total annual water investment needs could be as high as $13–18 billion.

TABLE 3.3.—ALTERNATIVE ESTIMATES OF REQUIRED INVESTMENT TO MEET WATER SUPPLY NEEDS, 1983–2000

[In billions of 1982 dollars]

	Annual investment
JEC study: Nationwide estimate	$5.34
National Water Commission (1973 study) [1]	4.99
Municipal and industrial	2.51
Irrigation and drainage	2.48
President's Water Policy Task Force [2] Needs of 765 Urban Water Supply Systems	6.3–9.1
Replacement and rehabilitation of existing systems	3.2–5.0
Servicing new growth	.6–1.0
New source development	2.5–3.1
Congressional Budget Office: [3] All multipurpose dam projects	2.90

[1] National Water Commission Staff Compilation prepared in 1982 as cited in "Proceedings of The National Water Symposium: Changing Directions in Water Management" p. 12. Annual figure, extrapolated from an estimate of investment was $2.1 billion needs in 1972 dollars, needs for 1970–2020.

[2] Findings as reported in Congressional Budget Office, "Public Works Infrastructure: Policy Considerations for the 1980's," April 1983, p. 132. If the findings are extrapolated to all community water systems, CBO estimates annual investment needs could be as high as $10–15 billion.

[3] Congressional Budget Office, "Public Works Infrastructure: Policy Considerations for the 1980's."

Ability To Meet Investment Needs

Another way of assessing the impact of this study's needs estimate is to compare it to recent levels of capital outlay and anticipated yearly revenues:

> Annual estimated investment requirements exceed recent levels of capital expenditure by 41 percent
>
> Needs exceed anticipated revenues by 76 percent.

TABLE 3.4.—WATER SUPPLY AND DISTRIBUTION INVESTMENT REQUIREMENTS CONTRASTED TO PRIOR YEAR CAPITAL EXPENDITURES AND ANTICIPATED REVENUES

[In billions of dollars]

Estimated annual investment requirement	$5.34
Capital outlays (1980–81)	3.78
Anticipated annual revenues	3.03

Conceptual and Methodological Issues Relating to Estimates of Water Needs and Revenue

Generally, the state researchers found it relatively easy to identiry the types of water problems which exist in their states, but difficult to estimate investment requirements or revenues. Indeed, several researchers reported that there was simply no basis for any estimate of needs, revenue or both. Other states provided a partial estimate based on a specific set of water needs eligible for funding under a state grant or loan program. Others depended on surveys of local water system officials to estimate both needs and revenues. Regardless of the method used, the estimates must be viewed with caution as they are often incomplete in coverage due to a lack of data and not comparable in scope from state to state.

Efforts to estimate water needs were stymied by many factors. Among them are:

1. *Number and diversity of organizational providers.* The sheer number of providers and the fact that many are investor-owned companies rather than governmental bodies make it difficult to amass consistent information on system condition, financing, projections of needs or revenues.

2. *Minimal state and federal government involvement.* The role played by state and federal governments in municipal and industrial water supply has been minimal; hence the record keeping associated with such involvement is nonexistent. While federal involvement in developing water for irrigation is somewhat greater, it is often difficult to isolate the agricultural, or municpal use portion of multiple-use water projects.

3. *Assessments of condition and estimates of repair and rehabilitation costs are difficult.* Much of the infrastructure associated with water distribution is not readily visible and assessments of condition are not easily done. Leakage is difficult to measure unless a system is fully metered; water main failures are difficult to predict.[19] Furthermore, since internal and external pipe corrosion and water main failures are influenced by a wide variety of conditions including water and soil type, external pressure, traffic vibrations, etc. it is difficult to apply rules of thumb regarding repair and replacement requirements. For example, no industry standard exists stating the age at which cast iron water mains should be replaced. Hence one approach typically used in the highway area (e.g., resurfacing required every *x* years at a specific cost per mile) is not available to researchers assessing water system needs.

4. *A significant amount of investment is required to meet projected increases in demand, yet demand is hard to forecast.* Clearly as an area experiences population and economic growth, some investment is required to provide new mains and connections. Investment in new source development and storage capacity may also be required but the calculation of amounts can be both difficult and controversial. Since the most easily developed sources have generally been utilized, the price of new water is likely to be substantially higher than that associated with existing supplies. If water is priced at the margin, consumption per capita is likely to be lower than current levels. Individuals would have an incentive to consume less and water systems an incentive to undertake repair and maintenance activities capable of reducing losses due to leakage or evaporation. Some industrial or agricultural users may be priced out of the market, ceasing their activities entirely or shifting to an area where water is more abundant and cheaper. While most analysts acknowledge the relationship between price and demand, it is nevertheless difficult to base projections of investment on an assumption of reduced demand. First, the political consequences of overestimating the price elasticity of demand and therefore of under investing in a new supply are great. Understandably, most system planners would prefer to have too much water than not en-

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[19] General Accounting Office, "Additional Federal Aid for Urban Water Distribution Systems Should Wait Until Needs Are Clearly Established," Nov. 24, 1980, CED-81-17, pp. 18-20, 28.

ought. Also, reallocations of water among users may be economically efficient; serious economic dislocations would occur in the area where an industry shuts down or farmers revert to dry-land techniques due to expensive water.

Projections on the revenue side are also difficult. Several researchers noted that water systems operate as utilities and that for the most part they finance their operations via user fees. They simply assumed that rates would be raised sufficiently to cover operating and capital costs. If this assumption is made, revenues are estimated to equal investment requirements.

If needs were estimated relative to a specific state financing program, then revenues were generally estimated by looking at authorized bond levels or appropriation amounts. An alternative approach was to look at past levels of capital expenditure by all water utilities and assume they would remain constant in real terms. Usually the source of information was the census.

Some researchers relied on surveys of local water system officials for estimates of both investment requirements and anticipated revenues. The assumptions underlaying respondents' estimates are generally unclear. Planning time frames vary. Some estimates are revenue constrained; others are not.

WASTEWATER COLLECTION AND TREATMENT

This aspect of infrastructure consists of several components.

1. *Sewage collection.* Piping is required to collect wastewater from individual homes and businesses and carry it to a treatment facility or disposal site.

2. *Wastewater treatment facilities and disposal.* Federal law mandates that a minimum of secondary treatment be achieved in all facilities. Secondary treatment requires a multiple step process and removes between 80 and 90 percent of organic materials and 80 percent or more of suspended solids. Depending on where the treated wastewater is to be discharged, other more advanced treatment technologies may be required to achieve water quality standards.

3. *Storm sewers and drains.* Storm sewer systems may or may not be connected to sanitary sewer systems. where combined sewers exist, sewage treatment facilities often have difficulty dealing with the extra flow generated during storms.

Sewage collection systems have long been recognized as necessary for the protection of public health in more urbanized areas. Treatment facilities were less common. Municipalities often ignored the ill consequences of raw sewage discharge into neighboring waterways. As concern with water pollution increased, however, more localities invested in treatment facilities. The passage of the Federal Water Pollution Control Act Amendments of 1972 marked adoption of a national commitment to improve water quality. The federal government mandated that all municipal wastes be treated at the secondary level or better. At the same time, it committed billions of dollars to a Wastewater Construction Grant Program.

Concern with contamination of ground water supplies has led many previously developed areas to invest in sewerage systems to replace individual disposal systems (septic or cesspool). Also, as economics force more future development onto smaller lot sizes, individual disposal systems become less practical. The extension of interceptor sewer lines becomes a crucial determinant of local land use patterns.

Wastewater collection and treatment systems are generally a local government responsibility. Some are municipally controlled but in many areas, a special district covering a broader area may be responsible at least for the treatment facility. States have responsibility for administering the federal water quality laws and construction grant programs. Some states also play a role in financing wastewater collection and treatment facilities.

While local government investment in sewerage systems has in part been a matter of local choice and consensus, other investments are dictated by federal law. In some areas, lack of compliance with federal and state clean water laws translates into a moratorium on future development.

Need Assessment: The National Perspective

Since the 1972 Act established clean water as a priority goal and committed the federal government to a major role in the clean-up effort, the Environmental Protection Agency (EPA) has been actively involved in assessing needs. Every two years EPA publishes a needs survey. Working closely with state officials, EPA conducts a survey of what investments will be required to comply with federal law. The need is assessed on a facility-by-facility basis taking into account the nature, size and cost of the facility required given information on the population and industries to be served.

Needs are broken down into several categories, the numbering of which corresponds to federal law.

I. Secondary Treatment: Facilities, including outfall sewers, needed to achieve secondary levels of treatment are covered in this category.

II. Advanced Treatment: Included are the incremental costs needed to achieve advanced secondary or other advanced levels of treatment.

III. Repair and Rehabilitation of Existing Sewers: Category A covers the cost of correcting sewer systems with infiltration/inflow problems. These problems usually arise when faulty joints in sewer piping systems or ground water conditions allow seepage of water into the system, thereby increasing the flow into the treatment facility. Category B includes the cost of replacing or rehabilitating sewers when necessary to maintain the total integrity of the system.

IV. New Sewers: Category A includes the costs of grant-eligible collector sewer systems designed to correct violations caused by raw discharges and to protect public health from such things as malfuctioning septic systems. Category B covers new interceptor sewers.

V. Control of Combined Sewer Overflow: This category includes costs of facilites to prevent or control periodic passing of untreated wastes from combined sewers to achieve water quality objectives.

VI. Control of Stormwater Runoff: The costs of abating pollution in urbanized areas from storm water runoff are included here.

EPA reports two needs figures:

Backlog needs.—This is the estimate of the cost of providing treatment service to the 1980 population for abatement of existing pollution problems.

Year 2000 needs.—This is the estimate of the cost of addressing all treatment for populations projected to be in place in the year 2000.

Table 3.5 shows that EPA's estimate of investment requirements through the year 2000 is $118 billion for categories I through V.[20] If all existing stormwater runoff problems were also addressed another $93 billion would be required. Backlog needs for categories I through V are $93 billion, or 78 percent of needs in the year 2000. The difference between the two figures is attributed to a projected 21 percent increase in population and to an increase in the percent of population projected to be served by municipal facilities from the present 71 percent to 92 percent in the year 2000.[21]

TABLE 3.5.—NATIONAL ASSESSMENT OF NEEDS FOR WASTEWATER TREATMENT FACILITIES

[In billions of 1982 dollars]

	Backlog estimate	Year 2000 estimate
I. Secondary treatment	$20.1	$31.1
II. Advanced treatment (AST and AT)	3.8	5.8
III. Sewer correction	7.3	7.3
IV. New sewers	25.7	38.5
V. Combined sewer overflows	35.7	35.7
VI. Stormwater	93.2	93.2
Totals: I. through V	92.6	118.4
Totals: All categories	185.8	211.6

EPA, "1982 Needs Survey: Cost Estimates for Construction of Publicly Owned Wastewater Treatment Facilities," table A, P. 6 and table 6, p. 48.

Assessing Needs: The State's Perspective

Most of our case-study states relied on the EPA needs assessment in reporting investment needs. Others, however, derived estimates from surveys of local officials who, for the most part, have direct responsibility for the construction, maintenance and operation of sewerage systems.

Among those who relied on EPA estimates, some limited their estimate of needs to those included in categories I through IV, but most included categories I through V. Only occasionally were stormwater control needs (category VI) incorporated in the estimate of investment requirements.

The 23 case-study states reported total investment requirements of $105.5 billion. If per capita needs of the case-study states are typical for those of the nation, then national needs for wastewater collection and treatment total $162.9 billion. This figure is larger than the figure of $118.4 billion cited by EPA for sanitary sewer and wastewater needs, but smaller than the total reported by EPA if urban storm water needs are taken into account as shown in Table 3.6.

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[20] It should be noted that while EPA reports the above needs, a significant portion are ineligible for funding under the federal construction grant program. For example, none of Category VI (Stormwater Control Costs) are eligible. Also the 1981 Construction Grant Amendments placed limits on how much of the cost of providing reserve capacity will be eligible for federal support. The reserve capacity limitation will make $11.1 billion of the $34.7 billion of costs for facilities included in categories I, II an IV-B ineligible for federal assistance. In addition, after 1984 the federal government will limit its participation in sharing the costs of sewer rehabilitation (III-B) and new collector systems (IV-A) by limiting the percentage of each state's annual grant that can be spent for these purposes. Also, the federal government will be reducing its share of costs on all grant eligible projects from 75 percent to 55 percent.

[21] EPA, "1982 Needs Survey," p. 7.

TABLE 3.6.—WASTEWATER COLLECTION AND TREATMENT ESTIMATED INVESTMENT REQUIREMENTS, 1983–2000

[In billions of 1982 dollars]

JEC study	$162.9
EPA estimates:	
Categories I through V	118.4
Categories I through VI	211.6

Several researchers indicated uncertainties or omissions in the EPA estimate of state needs. The Massachusetts case study, for example, noted that sewage treatment needs were well documented but that little was known about the condition of, and therefore investment levels required for, sewerage collection systems. The Oregon case study raised several concerns. Specifically:

> The Oregon needs that are not included in the EPA tally include several significant obligations that must be addressed if local jurisdictions are to have the infrastructure needed for growth and economic development. Three of these are as follows:
> 1. Collection systems to serve development new since 1982 or that can be projected as occurring by 2000.
> 2. Storm sewers and drainageway improvements.
> 3. Repair and replacement of the existing and new sanitary and stormwater conveyance and treatment systems.[22]

These omissions noted by the Oregon researchers are true for all states although the significance of the omitted needs might vary by state. EPA's estimate for new collector systems includes grant eligible facilities only; these are limited to areas known to have had pollution problems as of 1972, although the figures appear to allow for some growth within these areas. Entirely new areas of residential, commercial and industrial development must have sewage collection systems but the cost of these systems are not included in the EPA totals. Municipalities may require that these costs be borne by the developer rather than the city. Even so, the residents of the newly developed area will generally bear the cost of the required infrastructure either through increased land purchase prices or through property taxes levied to support bonds issued by special improvement districts. Costs associated with these new developments vary by state.

EPA's estimates of storm sewer needs are high ($93.2 billion). Even so, they only include costs of those systems needed for the improvement of water quality in selected urbanized areas. Stormwater systems may be required in other towns or municipalities either for pollution abatement or for drainage and flooding considerations. The third consideration raised by the Oregon case study is the cost of repairing or replacing infrastructure now in place. Treatment facilities and sewerage systems have relatively long useful lives. Even so, some repair and replacement of equipment or facilities are necessary. From a federal viewpoint once a facility is in place all responsibility for operations, maintenance and depreciation passes to the local government which owns the facility. Recurring capital requirements associated with these facilities fall outside the EPA purview.

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[22] Bureau of Governmental Research and Service, "Infrastructure Needs and Resources of Selected State and Local Government Program Oregon," p. 20.

The New York case study notes that EPA's need estimates are uncertain for several additional reasons that have application beyond its borders. First, final regulations governing secondary treatment have yet to be issued so the costs of meeting the secondary treatment requirement is unclear. The researchers note that several facilities in New York use secondary treatment methods but their effluent falls short of current standards. A second area of uncertainty relates to possible exemptions from secondary treatment requirements for coastal communities that could discharge wastes to marine environments. Such exemptions are possible under the Clean Water Act, but EPA's response in specific circumstances remains unclear. If a liberal exemption policy is followed, investment requirements could be lower in coastal states. Third, standards regarding certain toxic pollutants have not been set so the incremental costs associated with their removal have not been included in the EPA needs estimates.[23]

The case-study researchers noted several issues that, if taken into account, would raise the estimate of investment requirements. None, however, reported an alternative state estimate of needs based on water quality standards of their own choosing. Also, none questioned the relationship between treatment standards and actual improvements in water quality. Certainly both issues have been raised in national debate. Critics of federal regulations charge that the uniform requirement of secondary treatment is unreasonable since it may not always result in significant improvements in water quality. Treatment may be futile where external agricultural and/or natural causes impair water quality. In some instances treated wastewater is now cleaner than the natural water into which it empties. Critics argue treatment under such circumstances is inefficient. Another example is when wastewater empties into coastal waters and "natural currents cause mixing dilution and biology decomposition of waste in the discharge area," such that "environmental degradation does not result . . . regardless of the level of treatment."[24] Others argue that water quality standards should be lower for specific stream segments or bodies of water, thereby allowing higher levels of discharge and reducing treatment costs.

Why states did not propose a range of investment requirements based on alternative standards (as they did in other functional areas) is unclear. The explanation may lie in the fact that current standards are embodied in law rather than professional norm or administrative practice. Hence, investment levels may not be viewed as a matter of choice. Also, given current data collection systems and state of knowledge, the cost of producing alternative estimates of investment requirements may be very high.

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[23] Rae Zimmerman, "Infrastructure Needs Analysis for New York State," pp. 22-23.

[24] CBO, "Public Works Infrastructure Policy Consideration for the 1980s."

Ability To Meet Investment Needs

If a total investment of $162.9 billion is required through the year 2000, then annual capital expenditures (in constant 1982 dollars) should equal $9.1 billion. This figure is 24 percent greater than the amount actually spent by state and local governments in fiscal year 1981. The anticipated shortfall appears somewhat greater—$2.7 billion annually or 30 percent—if needs are contrasted with anticipated revenues.

The project revenue estimate is less than past funding levels since most researchers assumed a constant level of commitment by state and local government but a declining federal contribution as indicated by the 1981 construction grant amendments. Assumptions regarding the future of the federal grant program varied by state; some accepted the administration view that funding should be phased out after 1985 while others assumed that the federal government would pay its share of all of the needs identified as grant-eligible in EPA's 1982 needs survey.

TABLE 3.7.—WASTEWATER COLLECTION AND TREATMENT INVESTMENT REQUIREMENTS CONTRASTED TO PRIOR YEAR CAPITAL EXPENDITURES AND ANTICIPATED REVENUES

[In billions of dollars] [1]

Estimated investment requirement annualized	$9.05
State and local government capital outlays (1980–81)	6.91
Anticipated revenues annualized	6.31

[1] Estimated investment requirements and revenues in 1982 dollars; capital outlays are actual expenditures in fiscal 1980–81.

CONCLUSION

To meet basic infrastructure investment needs, approximately $1,157 billion should be invested through the year 2000. Highways and bridges account for 62 percent of the required investment level.

The States anticipate having at least $713.2 billion in revenues available to meet basic infrastructure investment needs. While an attempt was made to project all revenue sources, in some instances less information was available regarding revenues than needs.

Projected revenues fall short of needs by $443.9 billion. All governments combined must increase revenues by 62 percent in order to meet projected needs.

TABLE 3.8.—SUMMARY OF INVESTMENTS REQUIRED AND ANTICIPATED REVENUES FOR BASIC INFRASTRUCTURE

[In billions of 1982 dollars]

Functional category	Investment needs	Anticipated revenues	Financing gap
Highways and bridges	$720.2	$455.3	$264.9
Other transportation	177.8	89.7	88.1
Water supply, distribution and treatment systems	96.2	54.5	41.6
Wastewater collection and treatment systems	162.9	113.6	49.3
Total (all functions)	1,157.1	713.2	443.9

Chapter 4. REGIONAL COMPARISONS

The country is facing a difficult and challenging problem related to its inadequate infrastructure. Part of the problem is the aging of that infrastructure. A second and equally important part relates to revenue constraints and uncertainty. As L. Kenneth Hubbell noted in the Missouri case study, "In recent years, these sub-national governments have been squeezed by inadequate tax revenues, extremely high interest rates coupled with an economic recession and a diminution of federal grants and aids."

Is the infrastructure problem national in scope? Is it similar in its dimensions across regions? The intuitive belief is that, while each region in the country faces substantial infrastructure difficulties, the particular capital requirements and the problems associated with meeting these needs vary by region.

To date, this hypothesis has remained largely untested. This research points to answers to some complicated questions and issues.

> Do the states which comprise each region face problems (and solutions) which are similar or dissimilar?
>
> Is it possible that there is variation even within the regions which is so substantial that it masks any real variation between regions?
>
> Do regional differences appear in certain functional areas, but not in others? For example, are sewage treatment problems more prevalent in the northeast? Or are highway capital needs disproportionately a western problem?
>
> Most importantly, do states themselves face substantial variations which complicate infrastructure planning and development? That is, do most states really encounter the same simultaneous issues of growth and expansion, along with decay and revitalization, that regions of the country appear to be facing?

The data developed during this study point to some interesting regional and state variations which support some of the conventional hypotheses. But the data also suggest that simple "we-they" or "growth-decline" dichotomies are oversimplifications.

THE REGIONS

The 23 states [1] which participated in this study are divided into five regions. These states, according to census data, accounted for 144.9 million U.S. residents in 1980, or nearly 64 percent of the country's 1980 population. The assignment of states to regions is shown in Table 4.1.

Each region is fairly well represented with between three and seven states in each. Each region accounts for a minimum of 21 million residents. The regional analysis which follows is based on the experience of the case-study states only.

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[1] The summary of each case study is included in appendix A. Each case study will be published separately by the Joint Economic Committee.

TABLE 4.1.—STATE AND REGIONAL POPULATION DISTRIBUTION

Region and State	1980 population (thousands)	Percent of U.S. 1980 population
Northeast:		
Maine	1,125	0.5
Massachusetts	5,737	2.5
New Jersey	7,364	3.3
New York	17,557	7.8
Total	31,783	14.0
Midwest:		
Indiana	5,490	2.4
Missouri	4,917	2.2
Ohio	10,797	4.8
Total	21,204	9.4
South:		
Alabama	3,890	1.7
Florida	9,740	4.3
Kentucky	3,661	1.6
Maryland	4,216	1.9
North Carolina	5,874	2.6
South Carolina	3,199	1.4
Tennessee	4,591	2.0
Total	35,091	15.5
South-Central:		
Louisiana	4,204	1.9
Oklahoma	3,025	1.3
Texas	14,228	6.3
Total	21,457	9.5
West:		
California	23,669	10.4
Colorado	2,889	1.3
Montana	787	.3
New Mexico	1,300	.6
Oregon	2,633	1.2
Washington	4,130	1.8
Total	35,408	15.6
All case study States	144,943	64.0
U.S. total	226,505	100.0

Source: U.S. Bureau of the Census, "1980 Census of Population and Housing," Advance Reports, United States Summary, PHC 80–V–1.

THE HISTORICAL PERSPECTIVE

Before reviewing the projections of capital needs which were developed in the state case studies, it is helpful to examine some historical trends.

Historical analysis provides a consistent measure to indicate whether or not capital investment has been rising or falling in real terms by functional category. Historical data also suggests a real per capita expenditure level which can be used as a benchmark to compare projections of capital needs by category. Of course, historical expenditures, since they are constrained by available revenue, will likely be less than projected requirements, which are often based on broader measures of need.

The principal source of information used to contrast various regions and states is the U.S. Bureau of the Census Governmental Finances annual series. The Census reports state and local expenditures used for capital outlay by functional area. General expenditures include highways and sewerage; expenditures on water supply systems are considered utility expenditures. For this analysis, capital outlays for highways, sewerage and water supply systems have been examined in absolute and relative terms, by state, from fiscal year 1969 to fiscal year 1981.

The historical data reported in the census are in nominal or current dollar terms. For comparative purposes the data are converted into real capital outlays (in 1982 dollars). Then, to allow for size differences among the states, real dollar figures are examined on a per capita basis.

Table 4.2 summarizes the historical data by state, region and function. This summary focuses on a subjective assessment of the general trend in real per capita outlays for the years 1969 to 1981 (with increasing trends noted by a "+", decreasing trends indicated by a "−", and stable per capita outlays noted by a "o"). It averages the last three years (1979 to 1981) of real per capita outlays, reports the share of capital outlays for the three specific functions in 1981 and provides the basis for the discusssion which follows.

Regional Variations

The contrast among the regions is initially examined from the perspective of total capital outlays for highways, sewage and water supply combined and then by individual function. For each, general trends are described, average real per capita outlays are compared and relative capital outlay shares are determined.

Total outlays. For each region, total capital outlays for highways, sewerage and water supply shows a general decline in real terms. Only five of the 23 case-study states have general capital outlay trends which are characterized as flat. None are considered to be increasing their real investment in infrastructure.

The combined capital outlay figures reflect higher real per capita expenditures in the Sunbelt southern states and in the growing western states, while the lowest figures are reported in the northeast and midwest states. As shown in Table 4.3, real outlays range from a low of $106 in the Northeast to a high of $156 in the West. The average for all 23 states is $131 per capita.[2]

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[2] Generally, per capita figures used in the text are based on simple averages. The effect on regional comparisons of weighting projected per capita numbers by state population estimates is presented at the end of this chapter (see Tables 4.38 and 4.39).

TABLE 4.2.—SUMMARY OF HISTORICAL CAPITAL OUTLAYS BY STATE AND FUNCTIONAL AREA

State	Population (thousands) 1980	Highways			Sewerage			Water			Subtotal			Average annual aggregate real capital outlays (millions of dollars 1979–81
		General trend for real per capita outlays	Average 1979–81 real per capita outlays	Relative share of capital outlays (1981 percent)	General trend for real per capita outlays	Average 1979–81 real per capita outlays	Relative share of capital outlays (1981 percent)	General trend for real per capita outlays	Average 1979–81 real per capita outlays	Relative share of capital outlays (1981 percent)	General trend for real per capita outlays	Average 1979–81 real per capita outlays	Relative share of capital outlays (1981 percent)	
Northeast:														
Maine	1,125	–	73	34	0	20	13	0	20	6	–	113	54	220
Massachusetts	5,737	–	47	29	+	35	15	+	12	6	–	94	50	1,080
New Jersey	7,364	–	45	18	+	48	20	–	6	3	–	99	41	1,627
New York	17,557	–	65	31	+	45	16	–	7	3	–	118	49	4,195
Total or average	31,783		57	28		37	16		11	5		106	49	1,781
Midwest:														
Indiana	5,490	–	67	30	0	24	14	–	5	2	–	96	46	1,108
Missouri	4,917	–	80	32	+	32	19	–	7	4	–	120	54	1,071
Ohio	10,797	–	55	21	+	50	21	–	9	4	–	115	46	2,603
Total or average	21,204		67	28		35	18		7	3		110	49	1,594
South:														
Alabama	3,890	–	72	37	0	13	6	0	13	4	–	99	47	835
Florida	9,740	–	78	28	+	29	10	0	24	11	0	132	49	2,658
Kentucky	3,661	0	177	55	+	21	4	0	10	4	–	208	63	1,253
Maryland	4,216	–	92	30	–	39	15	–	23	8	–	153	52	1,442
N. Carolina	5,874	–	65	24	0	16	4	+	21	16	–	101	44	1,243
S. Carolina	3,119	–	42	17	0	17	8	0	17	11	0	76	37	649
Tennessee	4,591	–	82	31	0	20	12	0	28	11	–	130	54	1,172
Total or average	35,091		87	32		22	8		19	9		129	49	1,322

South-Central:													
Louisiana	4,204	—	103	38	—	15	7	—	9	4	—	127	49	1,188
Oklahoma	3,025	—	78	32	+	22	7	0	17	5	—	118	44	817
Texas	14,228	0	107	34	+	26	7	0	35	10	0	168	51	4,736
Total or average	21,457		96	35		21	7		21	6		138	48	2,247
West:													
California	23,669	—	42	19	+	27	11	—	18	10	—	86	40	4,926
Colorado	2,889	—	79	23	+	24	6	+	69	21	0	172	51	960
Montana	787	—	177	55	—	11	3	+	12	4	—	200	61	297
New Mexico	1,300	—	117	32	0	21	8	0	26	5	—	164	45	452
Oregon	2,633	—	94	30	0	33	9	0	30	9	0	157	48	905
Washington	4,130	—	116	30	0	25	4	0	16	3	—	157	37	1,584
Total or average	35,408		104	32		23	7		28	9		156	47	1,521

Trend Indicators: — = decrease; 0 = stable; + = increase.

TABLE 4.3.—TOTAL CAPITAL OUTLAYS FOR HIGHWAYS, SEWERAGE AND WATER SUPPLY

Region	Average annual (1979–81) real per capita outlays	Relative share of capital outlay (percent)	Average annual aggregate real capital outlay (millions of dollars) 1979–81
Northeast	$106	49	1,781
Midwest	110	49	1,594
South	129	49	1,322
South-Central	138	48	2,247
West	156	47	1,521

Part of the per capita differences between regions is attributable to the greater population densities in the older regions of the country. Part also is attributable to the overall significance of highway expenditures to total capital outlay across the nation. In this context, larger and less populated states illustrate relatively large per capita highway outlays. Moreover, the state case studies suggest older states have postponed infrastructure maintenance or revitalization. Growing states on the other hand are generally unable to defer needed investment in new infrastructure. This set of behavior patterns is understandable in light of differing economic environments. Finally it would be desirable to analyze respective state and regional "own source" per capita outlays in the context of "own source" revenues. Unfortunately, at the present time, this is impossible due to the absence of hard data for the studied infrastructure categories.

Despite the differences in total capital expenditures by region, the share devoted to the basic infrastructure categories of concern in this study is consistent across regions. Regardless of the region, outlays for highways, sewerage and water supply comprise not quite half of the total state and local capital expenditures. Combining this consistent relative expenditure level with the more variable per capita expenditure figures, it is clear that total capital outlays (including outlays for such other functional areas as education and hospitals) are lowest on a per capita basis in the Northeast and Midwest and highest in the South, South-Central and West.

Highways. In each region, highway capital outlays show a broad and general downward trend. Only two states—Kentucky and Texas—have shown relatively steady capital outlays for highways; however, expenditure levels do vary by region. In both absolute per capita terms and in relative terms highway expenditures are highest in the southern and western states (see Table 4.4).

TABLE 4.4.—CAPITAL OUTLAYS FOR HIGHWAYS

Region	Average annual real per capita outlays	(1979–81) relative share of capital outlay (percent)
Northeast	$57	28
Midwest	67	28
South	87	32
South-Central	96	35
West	104	32

Annual average expenditures in the Northeast and Midwest are less than two-thirds the level recorded in the South-Central and West.[3]

Intuitively one would expect highway capital outlays to be greatest in regions experiencing the greatest growth and in areas which are most sparsely populated. Furthermore, the older regions which largely have established federal and state highway systems could be expected to invest a relatively small share of their capital investment monies in highways.

The relative share of investment devoted to highways in all of the regions is very significant. The Northeast, which shows the smallest absolute level of expenditure on a per capita basis, still spends a sizable amount of its capital outlay dollars on highways. Of the three investment components under consideration, highway capital outlays in every region account for more than half of the combined expenditures on highways, sewerage and water. In the South-Central region, nearly 70 percent of the combined outlays for highways, sewerage and water is devoted to highways.

Sewerage. Unlike highway expenditures, which are declining across all regions, spending trends in sewerage treatment vary by state. No regional patterns are discernable. Only three of the case-study states have shown a decline in general capital expenditure trends for sewerage. On the other hand, 11 states have recorded increases in capital outlays for sewerage treatment. For many states, sewerage treatment capital outlays showed marked increases in the mid to late 1970's.

From an absolute and relative perspective, the highest real per capita expenditures are found in the Northeast and Midwest (see Table 4.5).

TABLE 4.5.—CAPITAL OUTLAYS FOR SEWERAGE

Region	Average annual (1979–81) real per capita outlays	Relative share of capital outlay (percent)
Northeast	$37	16
Midwest	35	18
South	22	8
South-Central	21	7
West	23	7

---

[3] The average per capita calculations noted here are simple averages; they are not weighted by the population in each state to determine a regional per capita figure.

The South, South-Central and West regions spend, on a per capita basis, about 60 percent of what the Northeast and Midwest states spend.

Not only do the Northeast and Midwest spend more per capita on sewerage treatment, they also devote a greater share of their total capital outlays to this function. The West, South and South-Central regions spend seven to eight percent of their capital budgets on this function, while in the Northeast and Midwest the share is 16 percent and 18 percent, respectively.

Water. Capital outlays associated with water supply, distribution and treatment for government-owned and operated water utilities are reported separately from other general government expenditures. Again, the overall trend among all the case-study states is uneven. Four states have recorded increases while a general decline in capital outlays is shown for eight states. By region, the general trend reflects a decline in water expenditures in the Northeast and Midwest, but with generally stable expenditures in the other three regions. The data show a reversal in the regional observations made about sewerage treatment.

The absolute and relative expenditures are smallest in the Northeast and Midwest and highest in the South, South-Central, and West (see Table 4.6).

TABLE 4.6.—CAPITAL OUTLAYS FOR WATER

Region	Average annual (1979–81) real per capita outlays	Relative share of capital outlay (percent)
Northeast	$11	5
Midwest	7	3
South	19	9
South-Central	21	6
West	28	9

Colorado over recent years has spent an average of $69 per capita on water capital outlays. This represents a considerable anomaly among the states and tends to drive the average per capita figure for the West upward. Even without Colorado, however, the average for the West remains above $20 per capita.

Variations Within Regions

While there are important differences in the pattern of capital outlays among regions, important variations exist within regions. In some instances, some of the regional variations may be explained in part by the experience of one or two states. The Colorado water expenditures cited above is such an example.

Other instances of variations within regions can be cited. For example, it was noted above that highway expenditures are greatest in the western and sunbelt states; yet it is ironic that the lowest real per capita expenditures on highways are found in South Carolina and California. Similarly, the greatest range in per capita highway expenditures is found in the South and West.

The table below portrays regional variability for the aggregate capital outlay on highways, sewerage and water.

TABLE 4.7.—TOTAL CAPITAL OUTLAYS FOR HIGHWAYS, SEWERAGE AND WATER SUPPLY

Region	Average annual (1979–81) real per capita outlays	Variability of capital outlays		
		Range		Standard deviation
		Low	High	
Northeast	$106	$94	$118	$11
Midwest	110	96	120	13
South	129	76	208	43
South-Central	138	118	168	27
West	156	86	200	38

Interestingly, the South records the lowest and the highest per capita figures in the study (South Carolina and Kentucky respectively). Kentucky's outlays are high largely due to its $177 per capita expenditure on highways, which ties with Montana as the highest among the case-study states. The distribution of per capita expenditures shows surprisingly little variability in the Northeast and Midwest. But the West, largely due to California's low capital outlay levels per capita, shows a considerable range.

Variations Among the States

Table 4.8 shows the ranking of the 23 case-study states according to their real per capita capital outlays over the past three years. The table shows several interesting trends. In terms of aggregate per capita capital outlays for highways, water and sewerage, the West, South and South-Central dominate. The top 10 states ranked in terms of the largest per capita capital outlays over the last three fiscal years are from these three regions. At the same time, it is ironic that the lowest two states in the ranking are also from these regions.

These observations are mirrored in the data for highway capital outlays. Kentucky and Montana have clearly spent at the highest per capita level ($177), and they are followed rather distantly by New Mexico ($117). Only six of the 23 states spent at a per capita rate of more than $100.

Water again is dominant in the West, South and South-Central. Colorado clearly leads the pack with a per capita expenditure level averaging $69 over the past three years. Colorado is followed by Texas ($35) and Oregon ($30). At the other extreme, of the seven case-study states representing the Northeast and Midwest, five spent less than $10 per capita on water supply, distribution and treatment.

Sewage treatment per capita capital outlays are largest in the Northeast and Midwest. Four of the top five states came from these two regions. The top three states are Ohio ($50), New Jersey ($48), and New York ($45). The bottom six states are from the West, South-Central and South Regions with the lowest being Montana, which spent at a rate of $11 per capita.

Variations Within States

While statistical information reflecting variability within states is limited, this variability clearly is present. For example, New

Jersey reported that, while some of its aging infrastructure dated back to pre-Civil War years, the State still faces the requirements of meeting the infrastructure demands associated with growth in certain areas. This is not an atypical trend—many states face declining rural populations and continued urbanization. Oklahoma, for instance, is characterized as rural, sparsely populated and agriculturally oriented in the western part of the state; the eastern portion is more urban, industrialized and growing. Colorado is in reality three or four states. Its Western Slope faces infrastructure problems related to an often cyclical energy-driven economy; its intramountain areas reflect infrastructure needs related to tourism; its Front Range area illustrates infrastructure priorities related to growth and revitalization; and its eastern slope needs are tied to agriculture. Many states report similar variations from one part of the state to another.

TABLE 4.8.—RANKING (HIGHEST TO LOWEST) OF STATES ACCORDING TO REAL PER CAPITA CAPITAL OUTLAYS, 1979 to 1981, BY FUNCTIONAL CATEGORY

[Infrastructure category]

Rank	Highways	Water	Sewerage	Total
1	Kentucky	Colorado	Ohio	Kentucky.
2	Montana	Texas	New Jersey	Montana.
3	New Mexico	Oregon	New York	Colorado.
4	Washington	Tennessee	Maryland	Texas.
5	Texas	New Mexico	Massachusetts	New Mexico.
6	Louisiana	Florida	Oregon	Oregon.
7	Oregon	Maryland	Missouri	Washington.
8	Maryland	North Carolina	Florida	Maryland.
9	Tennessee	Maine	California	Florida.
10	Missouri	California	Texas	Tennessee.
11	Colorado	Oklahoma	Washington	Louisiana.
12	Florida	South Carolina	Colorado	Missouri.
13	Oklahoma	Washington	Indiana	New York.
14	Maine	Alabama	Oklahoma	Oklahoma.
15	Alabama	Massachusetts	Kentucky	Ohio.
16	Indiana	Montana	New Mexico	Maine.
17	New York	Kentucky	Maine	North Carolina.
18	North Carolina	Louisiana	Tennessee	New Jersey.
19	Ohio	Ohio	South Carolina	Alabama.
20	Massachusetts	Missouri	North Carolina	Indiana.
21	New Jersey	New York	Louisiana	Massachusetts.
22	California	New Jersey	Alabama	California.
23	South Carolina	Indiana	Montana	South Carolina.

Source: See table 4.2.

Summary: The Historical Perspective

Historical capital outlays indicate that regional differences exist. On a per capita basis the greatest capital spending on highways, sewerage and water is found in the West, South-Central and South while the lowest spending levels have in recent years been recorded in the Northeast and Midwest. This is in part attributable to the dominance of highway spending in the growing and more sparsely populated western states. Capital outlay patterns indicate that highways and water are western and southern priorities while sewage treatment is a priority for the states in the Midwest and Northeast.

Despite these regional differences, it is also clear that distinguishing expenditures solely on a regional basis misses the uniqueness of the states within those regions and, in fact, misses the great variability even within the states themselves.

PROJECTED INFRASTRUCTURE NEEDS

Each of the case-study states has special needs related to the age, quantity and quality of their existing highway, water and sewerage systems. They also have special needs related to their geography, the spatial distribution of their populations, their climate, and their prospects for future growth.

Table 4.9 identifies projected capital needs, revenue and the anticipated revenue shortfall, if any, for each of the case-study states and by infrastructure category. Infrastructure needs and revenues are aggregated by function for all the states which provided estimates. Below the total estimates, the associated population figure is shown. Per capita need and revenue figures are derived and projections for any remaining case study states and the U.S. as a whole are developed assuming the per capita figures are representative for both.

As noted in the table, the most populous states project the greatest infrastructure needs. Specifically, New York projects capital requirements in excess of $100 billion in 1982 dollars over the 18-year period and California forecasts an infrastructure need in excess of $90 billion. When examining individual components of this total requirement, New York and California again rank first and second in terms of their requirements for sewage treatment facilities, water supply distribution and treatment, and other transportation. In terms of highways and bridges, Texas ranks as the number one state in terms of identified needs, followed by Ohio, New York and California. New York and California project revenue shortfalls over this period to be $40.6 billion and $42.8 billion respectively. No other state anticipates a shortfall greater than $20 billion, although several report gaps ranging from $10 to $20 billion.

Table 4.10 reports the same state-by-state projections of needs, revenue and the revenue shortfall on an annual average per capita basis and by region. By eliminating the population influence on capita need and revenue estimates, the state and regional emphasis changes. On a per capita basis, New York and California no longer appear to be carrying unusually large financial burdens. In fact, the largest per capita requirements are projected for Indiana, Alabama, and then New York (see Table 4.30).[4]

Table 4.11 compares average historical real per capita expenditures for capital outlays (from the years 1979 to 1981) with projected annual average real per capita capital needs based on 1990 census population projects (for the years 1983 to 2000). Two comments should be made regarding the evaluation of these data. First, where states were unable to project needs over the 1983 to

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[4] Indiana's subtotal of capital needs is not readily apparent. They were unable to project water needs. Even without an estimate of capital requirements for water, the three other functional components total to $405 per capita.

2000 period for certain functions, the table notes these omissions with a "not available" designation. For the subsequent analysis, average regional per capita needs have been calculated based only on those states which did provide projections of needs. Second, the relative share of capital outlays is based on the capital outlay projected for each functional area as a share of the total for the three major functional areas ignoring, for the moment, other transportation needs. The "other transportation" component, which varies considerably in its importance by state, is not included in portions of the analysis to provide greater comparability with previously cited census data.

Regional Variations

In each region, projected regional needs are considerably larger than historical expenditures. As in the case of the historical discussion, projected needs are examined from the perspective of total needs (i.e., highways, sewerage and water combined), and subsequently by the separate functional categories. Throughout this discussion, a comparison will be made with:

Historical capital outlays, which are an indication of revenue or politically-constrained needs;

The relative portion of the infrastructure requirement allocated to each of the individual components versus the historical relative share; and

Projected revenue for each functional area which will indicate the anticipated revenue shortfall or gap.

Total needs.[5] The highest projected annual average per capita total expenditures, as shown below, are forecast for the Midwest, followed by the South-Central, South, Northeast and West.

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[5] Regional averages are simple averages and not weighted by state populations. The impact of population weighting is discussed later in the chapter. Succinctly, using weighted averages often increases per capita figures in its older more densely populated regions.

TABLE 4.9.—PROJECTED CAPITAL NEEDS, REVENUE, AND REVENUE SHORTFALL FOR CASE-STUDY STATES AND THE UNITED STATES, BY FUNCTION

State	Population (thousands) 1990	Projected capital requirements 1983 to 2000 (millions of 1982 dollars)					Projected revenue 1983 to 2000 (millions of 1982 dollars)					Projected gap 1983 to 2000 (millions of 1982 dollars)				
		Highways	Other transportation	Sewer	Water	Total	Highways	Other transportation	Sewer	Water	Total	Highways	Other transportation	Sewer	Water	Total
Alabama	4,214	12,580	14,295	1,001	916	28,792	8,740	10,409	779	N/A	N/A	3,840	3,886	222	N/A	N/A
California	27,526	44,742	15,225	16,982	14,035	90,984	22,688	9,558	10,647	5,281	48,174	22,054	5,667	6,335	8,754	42,810
Colorado	3,755	9,300	4,450	1,230	2,020	17,000	7,700	2,050	660	2,020	12,430	1,600	2,400	570	0	4,570
Florida	13,316	26,559	1,445	1,588	1,254	30,846	16,600	827	873	1,254	19,554	9,959	618	715	0	11,292
Indiana	5,679	31,600	864	9,000	N/A	N/A	21,456	617	6,750	N/A	N/A	10,144	247	2,250	N/A	N/A
Kentucky	4,074	20,430	293	3,070	1,428	25,221	8,550	286	1,464	1,349	11,649	11,880	7	1,606	79	13,572
Louisiana	4,747	19,363	291	2,411	N/A	N/A	17,827	268	N/A	309	N/A	1,536	23	N/A	N/A	N/A
Maine	1,229	1,702	296	1,745	N/A	N/A	1,702	142	221	N/A	N/A	0	154	1,524	N/A	N/A
Maryland	4,491	15,691	1,398	1,609	633	19,331	7,327	1,128	3,258	1,734	13,447	8,364	270	−1,649	−1,101	5,884
Massachusetts	5,704	8,800	8,170	8,300	1,150	26,420	6,119	1,422	2,331	306	10,178	2,681	6,748	5,969	844	16,242
Missouri	5,077	19,888	1,704	3,082	1,691	26,365	9,090	645	1,379	613	11,727	10,798	1,059	1,703	1,078	14,638
Montana	888	3,186	90	115	86	3,477	1,599	72	115	14	1,800	1,587	18	0	72	1,677
New Jersey	7,513	17,914	5,573	5,888	3,010	32,385	8,485	3,290	3,636	1,905	17,316	9,429	2,283	2,252	1,105	15,069
New Mexico	1,536	2,650	396	356	1,214	4,616	1,680	190	89	1,214	3,173	970	206	267	0	1,443
New York	16,457	45,600	37,300	17,300	7,200	107,400	34,452	14,076	14,600	3,654	66,782	11,148	23,224	2,700	3,546	40,618
North Carolina	6,473	18,860	1,023	1,774	1,829	23,486	13,810	74	1,384	1,312	16,580	5,050	949	390	517	6,906
Ohio	10,763	47,367	4,096	10,863	N/A	N/A	9,877	920	8,857	N/A	N/A	37,490	3,176	2,006	N/A	N/A
Oklahoma	3,503	12,400	129	300	4,300	17,129	7,700	N/A	21	N/A	N/A	4,700	N/A	279	N/A	N/A
Oregon	3,319	6,957	1,359	3,600	3,500	15,416	5,208	1,013	2,000	1,700	9,921	1,749	346	1,600	1,800	5,495
South Carolina	3,560	5,409	184	990	426	7,009	N/A	N/A	900	426	N/A	N/A	N/A	90	0	N/A
Tennessee	5,073	24,944	527	1,973	1,210	28,654	17,921	454	1,065	N/A	N/A	7,023	73	908	N/A	N/A
Texas	17,498	58,400	N/A	5,700	6,000	N/A	52,700	N/A	N/A	N/A	N/A	5,700	N/A	N/A	N/A	N/A
Washington	5,012	12,146	N/A	6,623	1,733	N/A	7,181	N/A	2,425	1,733	N/A	4,965	N/A	4,198	0	N/A
Total	161,407	466,488	99,108	105,500	53,635		288,412	47,441	63,454	24,824		178,076	51,667	42,046	28,811	
Associated population		161,407	138,897	161,407	138,989		157,847	131,834	139,162	113,448						
Case study State estimate		466,488	115,170	105,500	62,286	749,444	294,917	58,083	73,597	35,318	461,915	171,571	57,087	31,903	26,968	287,529
Per capita needs		2,890	714	654	386		1,827	360	456	219		1,063	354	198	167	
U.S. population	249,203															
Total U.S. needs		720,230	177,815	162,886	96,166	1,157,097	455,334	89,677	113,630	54,529	713,170	264,896	88,139	49,256	41,637	443,928

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TABLE 4.10.—PROJECTED PER CAPITA CAPITAL NEEDS, REVENUE AND REVENUE SHORTFALL BY REGION

Region and State	Population (thousands) 1990	Projected average annual per capita capital needs (1983–2000)				Projected average annual per capita capital needs (1983–2000)				Projected average annual per capita capital needs (1983–2000)			
		Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal
Northeast:													
Maine	1,229	77	79	N/A	N/A	77	10	N/A	N/A	0	69	N/A	N/A
Massachusetts	5,704	86	81	11	178	60	23	3	85	26	58	8	92
New Jersey	7,513	132	44	22	198	63	27	14	104	70	17	8	95
New York	16,457	154	58	24	237	116	49	12	178	38	9	12	59
Average		112	65	19	197	79	27	10	116	33	38	9	81
Midwest:													
Indiana	5,679	309	88	N/A	N/A	210	66	N/A	N/A	99	22	N/A	N/A
Missouri	5,077	218	34	19	270	99	15	7	121	118	19	12	149
Ohio	10,763	244	56	N/A	N/A	51	46	N/A	N/A	194	10	N/A	N/A
Average		257	59	19	335	120	42	7	169	137	17	12	166
South:													
Alabama	4,214	166	13	12	191	115	10	N/A	N/A	51	3	N/A	N/A
Florida	13,316	111	7	5	123	7	4	5	16	104	3	0	107
Kentucky	4,074	279	42	19	340	117	20	18	155	162	22	1	185
Maryland	4,491	194	20	8	222	91	40	21	152	103	−20	−14	69
North Carolina	6,473	162	15	16	193	119	12	11	142	43	3	4	51
South Carolina	3,560	84	15	7	107	N/A	14	7	N/A	N/A	1	0	N/A
Tennessee	5,073	273	22	13	308	196	12	N/A	N/A	77	10	N/A	N/A
Average		181	19	11	212	107	16	13	136	74	3	−1	76

South-Central:													
Louisiana	4,747	227	28	N/A	N/A	209	N/A	4	N/A	18	N/A	N/A	N/A
Oklahoma	3,503	197	5	68	270	122	0	N/A	N/A	75	4	N/A	N/A
Texas	17,498	185	18	19	223	167	N/A	N/A	N/A	18	N/A	N/A	N/A
Average		203	17	44	264	166	0	4	170	37	17	40	94
West:													
California	27,526	90	34	28	153	46	21	11	78	45	13	18	75
Colorado	3,755	138	18	30	186	114	10	30	154	24	8	0	32
Montana	888	199	7	5	212	100	7	1	108	99	0	5	104
New Mexico	1,536	96	13	44	153	61	3	44	108	35	10	0	45
Oregon	3,319	116	60	59	235	87	33	28	149	29	27	30	86
Washington	5,012	135	73	19	227	80	27	19	126	55	47	0	102
Average		129	34	31	194	81	17	22	120	48	17	9	74

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TABLE 4.11.—COMPARISON OF HISTORICAL PER CAPITA OUTLAYS AND PROJECTED PER CAPITA NEEDS

Region and State	Historical average per capita capital outlays (1979–81)				Projected average per capita capital needs (1983–2000)				Projected percentage increase in capital needs over historical capital outlays			
	Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal
Northeast:												
Maine	73	20	20	113	77	79	N/A	N/A	6	304	N/A	N/A
Massachusetts	47	35	12	94	86	81	11	178	82	132	−7	89
New Jersey	45	48	6	99	132	44	22	198	196	−8	239	100
New York	65	45	7	118	154	58	24	236	136	28	238	100
Average	57	37	11	106	112	66	19	197	96	77	66	86
Midwest:												
Indiana	67	24	5	96	309	88	N/A	N/A	361	272	N/A	N/A
Missouri	80	32	7	120	218	34	19	271	173	5	157	126
Ohio	55	50	9	115	244	56	N/A	N/A	340	12	N/A	N/A
Average	67	35	7	110	257	59	19	335	281	67	159	204

TABLE 4.11.—COMPARISON OF HISTORICAL PER CAPITA OUTLAYS AND PROJECTED PER CAPITA NEEDS—Continued

Region and State	Historical average per capita capital outlays (1979–81)				Projected average per capita capital needs (1983–2000)				Projected percentage increase in capital needs over histroical capital outlays			
	Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal	Highways	Sewerage	Water	Subtotal
South:												
Alabama	72	13	13	99	166	13	12	191	129	−2	−11	93
Florida	78	29	24	132	111	7	5	123	43	−76	−79	−6
Kentucky	177	21	10	208	279	42	19	340	57	102	92	63
Maryland	92	39	23	153	194	20	8	222	111	−48	−65	45
North Carolina	65	16	21	101	162	15	16	193	148	−4	−22	90
South Carolina	42	17	17	76	84	15	7	106	98	−13	−58	39
Tennessee	82	20	28	130	273	22	13	308	233	10	−53	137
Average	87	22	19	129	181	19	11	212	108	−14	−41	65
South-Central:												
Louisiana	103	15	9	127	227	28	N/A	N/A	120	90	N/A	N/A
Oklahoma	78	22	17	118	197	5	68	270	151	−77	292	129
Texas	107	26	35	168	185	18	19	222	73	−31	−46	32
Average	96	21	21	138	203	17	44	264	111	−19	111	91
West:												
California	42	27	18	86	90	34	28	152	116	28	56	76
Colorado	79	24	69	172	138	18	30	186	74	−24	−56	8
Montana	177	11	12	200	199	7	5	211	13	−36	−58	6
New Mexico	117	21	26	164	96	13	44	153	−18	−39	71	−7
Oregon	94	33	30	157	116	60	59	235	24	81	99	50
Washington	116	25	16	157	135	73	19	227	16	190	22	45
Average	104	23	28	156	129	34	31	194	24	46	9	24

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TABLE 4.12.—TOTAL PROJECTED CAPITAL OUTLAYS FOR HIGHWAYS, SEWERAGE AND WATER SUPPLY

Region	Average annual (1983–2000) real per capita needs	Relative share of capital outlay (percent)
Northeast	$197	100
Midwest	335	100
South	212	100
South-Central	264	100
West	194	100

These projections do not include the requirements associated with "other transportation." These subtotals are the sum of three functional averages for each region. Several states were unable to estimate their water needs; in these cases, regional averages are the simple means for the states which did provide estimates.

When contrasted with historical per capita outlays, all regions show projected needs greatly in excess of recent level of capital investment (see Table 4.13).[6]

TABLE 4.13.—A COMPARISON OF HISTORICAL PER CAPITA CAPITAL OUTLAYS WITH PROJECTED PER CAPITA CAPITAL NEEDS FOR HIGHWAYS, SEWERAGE AND WATER SUPPLY

Region	Average annual (1979–1981) real per capita outlays	Projected annual (1983–2000) real per capita needs	Percent increase
Northeast	$106	$197	86
Midwest	110	335	204
South	129	212	65
South-Central	138	264	91
West	156	194	24

In the Midwest, capital expenditures will have to more than triple if needs are to be met. The lowest required increase to meet projected needs is recorded in the West. All regions report future needs to be in excess of recent levels of capital expenditure.

Projected capital needs must be placed in perspective by examining the anticipated revenues which might be available to meet these needs. As indicated previously, revenue projections proved to be even more difficult to develop than forecasts of capital need requirements. The data below indicate generally the states' anticipated revenue stream which would be available to finance capital needs (see Table 4.14).

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[6] Average per capita outlays for the 1979–81 period are based on 1980 census population. Projected per capita needs are based on 1990 census projection.

TABLE 4.14.—PROJECTED PER CAPITA CAPITAL NEEDS VERSUS PROJECTED PER CAPITA REVENUE FOR TOTAL INFRASTRUCTURE NEEDS

Region	Projected annual real per capita needs	Projected annual real per capita revenue	Projected annual per capita revenue shortfall
Northeast	$197	$116	$81
Midwest	335	169	166
South	212	136	76
South-Central	264	[1] 170	94
West	194	120	74

[1] Revenue projections in the South-Central Region largely relate to the anticipated revenue associated with highways.

Each region will experience a revenue shortfall or gap ranging from $74 per capita to $166 per capita. This gap can be placed in perspective by recalling that recent actual capital outlays on a per capita basis have ranged from $106 to $156. Thus, the projected gaps for these regions amount to nearly the level of recent capital spending in the regions.

Many states relied upon recent expenditure levels as a major indicator of future revenues. Thus, it would be expected that projected revenues would not deviate substantially from recent levels of capital outlay. For instance, historical spending in the Northeast is at a rate of $106 per capita versus the projected $116 per capita. The projection of revenue per capita in the South also comparable to recent spending levels. The projected revenue figures are higher relative to historical spending in the Midwest and South-Central. Somewhat lower projections of revenue relative to historical spending are projected in the West.

Highways. Of the three components of infrastructure addressed in this analysis, clearly outlays for highways and bridges are financially dominant. For the 23 case-study states, a total capital needs projection of $466 billion was developed. This accounts for 62 percent of the $749 billion projected for the aggregate needs of transportation including the other transportation category, sewerage and water. Assuming the per capita expenditure relationships apply to the nation, total U.S. highway needs are projected to be $720 billion over the 1983 to 2000 period in 1982 dollars.

The states projecting the greatest requirements for highway capital investment are closely related in geographic and population size. The top ranked states are Texas, Ohio and New York.

TABLE 4.15.—STATES WITH THE LARGEST PROJECTED HIGHWAY NEEDS

Rank	State	Region	Projected 1983–2000 highway capital needs (billions of 1982 dollars)
1	Texas	South-Central	$58.4
2	Ohio	Midwest	47.4
3	New York	Northeast	45.6
4	California	West	44.7
5	Indiana	Midwest	31.6

On a per capita basis, regional expenditure patterns are more apparent. On this basis the greatest needs are projected for the Midwest where a requirement of $257 per capita is forecast. This region also accounts for the largest increase (281 percent) in needs over recent historical levels of capital outlay. Interestingly, the highest historical capital outlays are found in the West, but this region projects a relatively moderate increase in per capita needs of 24 percent (see Table 4.16).

TABLE 4.16.—A COMPARISON OF HISTORICAL PER CAPITA CAPITAL OUTLAYS WITH PROJECTED PER CAPITA CAPITAL NEEDS FOR HIGHWAYS

Region	Average annual (1979–1981) real per capita outlays	Projected annual (1983–2000) real per captia needs	Percent increase
Northeast	$57	$112	96
Midwest	67	257	281
South	87	181	108
South-Central	96	203	111
West	104	129	24

The Northeast, consistent with historical data, continues to show the lowest per capita level of anticipated capital outlay for highways. This in part, as noted earlier, is attributable to the population density in the states comprising the Northeast region and the fact that new highway construction has slowed. Recognizing the size of the populations and the spatial distribution of the populations in the various regions, it would appear that the moderate level of projected needs in the West is comparatively low. The three states comprising the Midwest each project needs in excess of $200 per capita; Indiana projects per capita needs to be $309.

A strong reflection of the importance of highways and bridges in the case-study state estimates is reflected in the proportion of total spending being allocated to this category (see Table 4.17).

TABLE 4.17.—PROJECTED CAPITAL OUTLAYS FOR HIGHWAYS RELATIVE TO TOTAL PROJECTED REQUIREMENTS FOR HIGHWAYS, SEWERAGE AND WATER NEEDS

Region	Average annual (1983–2000) real per capita needs	Relative share of capital needs (percent)
Northeat	$112	57
Midwest	257	77
South	181	85
South-Central	203	77
West	129	66

Of the three functional areas examined, the needs identified for highways and bridges are by far the largest. While the relative importance of highways might appear unduly large, this is generally consistent with the historical relationship among the three categories. For the years 1979 to 1981, the share devoted to highway capital improvements was: Northeast—56 percent; Midwest—61 percent; South—69 percent; South-Central—70 percent; West—67 percent.

For certain regions, notably the Northeast and the West, the projected share of future capital needs allocated to highways is not dissimilar from recent expenditure patterns. The Midwest and South projections show a much greater portion of the respective regions' capital investment dollars being devoted to highways and bridges in the future. The relative share is also somewhat higher in the South-Central.

Projections of per capita revenue available for highway capital outlays range from $79 in the Northeast to $166 in the South-Central. The revenue projections yield gaps ranging from $33 in the Northeast to $137 in the Midwest.

TABLE 4.18.—PROJECTED PER CAPITA CAPITAL NEEDS VERSUS PROJECTED PER CAPITA REVENUE FOR HIGHWAYS

Region	Projected annual per capita needs	Projected annual per capita revenue	Revenue shortfall
Northeast	$112	$79	$33
Midwest	257	120	137
South	181	107	74
South-Central	203	166	37
West	129	81	48

A comparison of projected revenues with historical outlays shows four of the five regions projecting revenues which are higher than historical expenditures.

Sewerage. Total sewerage system needs are projected to be approximately $106 billion in the case-study states and $163 billion nationally over the 1983 to 2000 period. As noted in the previous chapter, many states relied upon the EPA Needs Survey as a principal source for their projections.

The greatest sewerage system capital investment needs are in the most populous states. The five largest projections of need by state are shown in Table 4.19. The top-ranked states are New York and California, each estimating investment requirements of $17 billion.

TABLE 4.19.—STATES WITH THE LARGEST PROJECTED SEWERAGE TREATMENT NEEDS

Rank	State	Region	Projected 1983-2000 sewerage treatment needs (billions of 1982 dollars)
1	New York	Northeast	$17.3
2	California	West	17.0
3	Ohio	Midwest	10.9
4	Indiana	Midwest	9.0
5	Massachusetts	Northeast	8.3

Annual sewerage needs are projected to exceed recent expenditure levels in three of the five regions—Northeast, Midwest and West. In the other two, the South and South-Central, projected needs are slightly below historical capital outlay levels. The greatest needs are projected for the Northeast and Midwest. Sewerage treatment needs in these two regions are about three to four times the projected needs for the South and South-Central. The table below compares projected per capita needs with historical per capita capital outlays for sewerage treatment.

TABLE 4.20.—A COMPARISON OF HISTORICAL PER CAPITA CAPITAL OUTLAYS WITH PROJECTED ANNUAL PER CAPITA NEEDS FOR SEWERAGE TREATMENT

Region	Average annual (1979–1981) real per capita outlays	Projected annual (1983–2000) real per capita needs	Percent increase
Northeast	$37	$66	77
Midwest	35	59	67
South	22	19	−14
South-Central	21	17	−19
West	23	34	46

Relative to total expenditures, spending on sewerage treatment is a fairly modest component of infrastructure demand. However, as shown below, the proportion of aggregate capital needs attributable to sewerage treatment varies dramatically by region.

TABLE 4.21.—PROJECTED CAPITAL OUTLAYS FOR SEWERAGE TREATMENT RELATIVE TO TOTAL PROJECTED REQUIREMENTS FOR HIGHWAYS, SEWERAGE AND WATER NEEDS

Region	Average annual (1983–2000) real per capita needs	Relative share of capital needs (percent)
Northeast	$66	34
Midwest	59	18
South	19	9
South-Central	17	6
West	34	18

Revenue projections, as noted below, are variable and range from an unrealistic $0 per capita to $42 per capita. The South-Central, which has three representative states, had two states which were unable to provide revenue estimates and a third which estimated revenues to be unrealistically at zero.

It would appear reasonable to expect the largest gaps to be in the Northeast and the Midwest where the largest needs are projected. In fact, the largest gap does appear in the Northeast, but sizable gaps are also noted in the South-Central and West as well as the Midwest. One of these regions, the Midwest, largely due to the projected revenues of Indiana and Ohio, shows a healthy $42 per capita in revenue, resulting in a shortfall of $17 per capita.

TABLE 4.22.—PROJECTED PER CAPITA CAPITAL NEEDS VERSUS PROJECTED PER CAPITA REVENUE FOR SEWERAGE TREATMENT

Region	Projected annual real per capita needs	Projected annual real per capita revenue	Projected annual per capita revenue shortfall
Northeast	$66	$27	$38
Midwest	59	42	17
South	19	16	3
South-Central	17	0	17
West	34	17	17

In sum, the largest sewage treatment needs in both an absolute and relative sense are projected in the Northeast and Midwest. The smallest are forecast for the South and South-Central. The West falls in the middle.

Water. Total water needs are projected to be $62 billion for the 23 case-study states and $91 billion for the nation as a whole.

Water needs are highest in California by a considerable margin. Other states projecting sizable capital investment requirements for water are New York, Texas and Oklahoma.

TABLE 4.23.—STATES WITH THE LARGEST PROJECTED WATER NEEDS

Rank	State	Region	Projected 1983-2000 water needs (billions of 1982 dollars)
1	California	West	$14.0
2	New York	Northeast	7.2
3	Texas	South-Central	6.0
4	Oklahoma	South-Central	4.3
5	Oregon	West	3.5

Projected needs for water supply, treatment and distribution indicate, as shown below, that water is predominatly a concern of the South-Central and West Regions.

TABLE 4.24.—A COMPARISON OF HISTORICAL PER CAPITA CAPITAL OUTLAYS WITH PROJECTED PER CAPITA CAPITAL NEEDS FOR WATER SUPPLY, DISTRIBUTION AND TREATMENT

Region	Average annual (1979–1981) real per capita outlays	Projected annual (1983–2000) real per capita needs	Percent increase
Northeast	$11	$19	66
Midwest	7	19	159
South	19	11	−41
South-Central	21	44	111
West	28	31	9

The greatest regional need appears to be in the South-Central region. This is largely a reflection of the $68 per capita figure developed for Oklahoma. Oklahoma's needs reflect varied conditions within the state: it is semi-arid and had a depleting aquifer in the western part of the state causing a water-supply problem, while in the eastern part of the state there is an abundance of water but numerous communities face water distribution and treatment problems. In the West, high per capita needs are projected for Oregon and New Mexico. More modest needs are projected for the Northeast, Midwest and South.

Compared with historical capital outlays, each region, with the exception of the South, forecasts increased per capita capital expenditures on water. The South-Central, again due to the projected needs of Oklahoma, shows a projected need which is 111 percent greater than historic water outlays.

The relative distribution of projected capital outlays reflects the somewhat minor relative infrastructure role that water plays in the Midwest and South, but the important part water assumes in the South-Central and West. Of the total capital outlays forecast for water, highways, and sewerage systems, water requirements accounted for 17 percent and 16 percent of the needs respectively for the South-Central and the West. The shares in the South and Midwest are five and seven percent respectively. The table below shows the relative share for each region.

TABLE 4.25.—PROJECTED CAPITAL OUTLAYS FOR WATER RELATIVE TO TOTAL PROJECTED REQUIREMENTS FOR HIGHWAYS, SEWERAGE AND WATER

Region	Average annual (1983–2000) real per capita needs	Relative share of capital needs (percent)
Northeast	$19	10
Midwest	19	7
South	11	5
South-Central	44	17
West	31	16

Several states had difficulty making projections of revenue for water. As a result, two regional revenue estimates are based on input from only one state in each respective region. Missouri's estimate of $7 per capita represents the midwest region while Louisiana's estimate of $4 represents the South-Central region.

TABLE 4.26.—PROJECTED PER CAPITA CAPITAL NEEDS VERSUS PROJECTED PER CAPITA REVENUE FOR WATER SUPPLY, DISTRIBUTION AND TREATMENT

Region	Projected annual real per capita needs	Projected annual real per capita revenue	Projected annual per capita revenue shortfall
Northeast	$19	$10	$9
Midwest	19	7	12
South	11	13	−2
South-Central	44	4	40
West	31	22	9

The resultant revenue shortfall is by far the greatest in the South-Central region where needs are projected to be the greatest and revenues projected to be the lowest. More moderate gaps are indicated for the Northeast, Midwest and West with the South actually showing more revenue than needs. The anomaly in the South is a function of Maryland's projection of revenues per capita of $21 and needs per capita of $8.

Other transportation. This component of infrastructure consists largely of needed capital investments in ports, airports, railroads and mass transit. This category frequently involves the private sector as much as, if not more than, the public sector. It is a functional area for which projected data are not directly comparable to the historical capital outlay data.

Total capital investment requirements for other transportation in the case-study states is estimated to be $115 billion from 1983 to 2000. For the country, an estimate of $178 billion is developed. As before, this national estimate is based on the assumption that the per capita requirements from the case-study states can be applied to the country as a whole. This assumption is perhaps more questionable for this functional category than others, since a few states, such as New York, would be expected to have disproportionately large requirements.

Other transportation proved to be of critical importance to certain states. These states typically had sizable needs associated with developing or maintaining ports or mass transit systems. The states forecasting the largest other transportation per capita needs are:

TABLE 4.27.—STATES WITH THE LARGEST PROJECTED OTHER TRANSPORTATION NEEDS

Rank	State	Region	Projected 1983–2000 other transportation needs (in billions of 1982 dollars)
1	New York	Northeast	$37
2	California	West	15
3	Alabama	South	14
4	Massachusetts	Northeast	8
5	New Jersey	Northeast	6

On a per capita basis, the largest need is projected for the Northeast, largely reflecting per capita need estimates for New York ($126 per capita) and Massachusetts ($80 per capita). This region also reflects the greatest gap between revenues and needs ($42 per capita annually).

TABLE 4.28.--PROJECTED PER CAPITA CAPITAL NEEDS VERSUS PROJECTED PER CAPITA REVENUE FOR OTHER TRANSPORTATION

Region	Projected annual real per capita needs	Projected annual real per capita revenue	Projected annual per capita revenue shortfall
Northeast	$65	$23	$42
Midwest	16	6	10
South	33	27	6
South-Central	3	3	0
West	28	16	12

The forecasts of other transportation needs are variable across the various regions. This variability is attributable to the fact that many states were unable to provide estimates for one or more of the other transportation subcategories, either because data were unavailable or the subcategory was not important in the state. Two states project needs to be in excess of $100 per capita—one in the Northeast and one in the South—which dramatically inflate the average per capita figures for these regions.

Including other transportation not only increases the overall needs estimate for each region but also affects the relative regional distribution of needs. As was noted earlier, the total needs (aggregating three functional categories) were highest in the Midwest ($335 per capita) and lowest in the West ($194 per capita) and Northeast ($197 per capita). Table 4.29 reports projected needs when estimates for other transportation are included. Including other transportation increases each regional per capita need estimate but tightens the range of regional estimates from a low of $222 per capita in the West to a high of $351 per capita in the Midwest. In particular, the Northeast needs estimate increases by $65 per capita.

TABLE 4.29.—TOTAL PROJECTED PER CAPITA CAPITAL REQUIREMENTS AND REVENUE FOR HIGHWAYS, SEWERAGE, WATER AND OTHER TRANSPORTATION

Region	Needs	Revenue	Shortfall
Northeast	$262	$139	$123
Midwest	351	175	176
South	245	163	82
South-Central	266	173	93
West	222	136	86

TABLE 4.30.—PROJECTED PER CAPITA NEEDS, REVENUE AND REVENUE SHORTFALL BY REGION

Region and State	Population (thousands) 1990	Projected average annual per capita capital needs (1983–2000)					Projected average annual per capita revenue (1983–2000)					Projected average annual per capita gap (1983–2000)				
		Highways	Others	Sewerage	Water	Sutotal	Highways	Others	Sewerage	Water	Sutotal	Highways	Others	Sewerage	Water	Sutotal
Northeast:																
Maine	1,229	77	13	79	N/A	N/A	77	6	10	N/A	N/A	0	7	69	N/A	N/A
Massachusetts	5,704	86	80	81	11	257	60	14	23	3	99	26	66	58	8	158
New Jersey	7,513	132	41	44	22	239	63	24	27	14	128	70	17	17	8	111
New York	16,457	154	126	58	24	363	116	48	49	12	225	38	78	9	12	137
Average		112	65	65	19	262	79	23	27	10	139	33	42	38	9	123
Midwest:																
Indiana	5,679	309	8	88	N/A	N/A	210	6	66	N/A	N/A	99	2	22	N/A	N/A
Missouri	5,077	218	19	34	19	289	99	7	15	7	128	118	12	19	12	160
Ohio	10,763	244	21	56	N/A	N/A	51	5	46	N/A	N/A	194	16	10	N/A	N/A
Average		257	16	59	19	351	120	6	42	7	175	137	10	17	12	176
South:																
Alabama	4,214	166	188	13	12	380	115	137	10	N/A	N/A	51	51	3	N/A	N/A
Florida	13,316	111	6	7	5	129	7	3	4	5	19	104	3	3	0	109
Kentucky	4,074	279	4	42	19	344	117	4	20	18	159	162	0	22	1	185
Maryland	4,491	194	17	20	8	239	91	14	40	21	166	103	3	−20	−14	73
N. Carolina	6,473	162	9	15	16	202	119	1	12	11	142	43	8	3	4	59
S. Carolina	3,560	84	3	15	7	109	N/A	N/A	14	7	N/A	N/A	N/A	1	0	N/A
Tennessee	5,073	273	6	22	13	314	196	5	12	N/A	N/A	77	1	10	N/A	N/A
Average		181	33	19	11	245	107	27	16	13	163	74	6	3	−1	82

South-Central:																
Louisiana	4,747	227	3	28	N/A	N/A	209	3	N/A	4	N/A	18	0	N/A	N/A	N/A
Oklahoma	3,503	197	2	5	68	272	122	N/A	0	N/A	N/A	75	N/A	4	N/A	N/A
Texas	17,498	185	N/A	18	19	N/A	167	N/A	N/A	N/A	N/A	18	N/A	N/A	N/A	N/A
Average		203	3	17	44	266	166	3	0	4	173	37	0	17	40	93
West:																
California	27,526	90	31	34	28	184	46	19	21	11	97	45	11	13	18	86
Colorado	3,755	138	66	18	30	252	114	30	10	30	184	24	36	8	0	68
Montana	888	199	6	7	5	218	100	5	7	1	113	99	1	0	5	105
New Mexico	1,536	96	14	13	44	167	61	7	3	44	115	35	7	10	0	52
Oregon	3,319	116	23	60	59	258	87	17	33	28	166	29	6	27	30	92
Washington	5,012	135	N/A	73	19	N/A	80	N/A	27	19	N/A	55	N/A	47	0	N/A
Average		129	28	34	31	222	81	16	17	22	136	48	12	17	9	86

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The revenue gap for other transportation also reflects considerable variation by state. The greatest gaps are found in New York, Massachusetts, Alabama and Colorado. Each of these four states projects a gap in excess of $35 per capita. The remaining states project gaps of less than $20 per capita.

Table 4.30 identifies projected per capita capital investment needs, revenue and revenue shortfall by region including each of the four infrastructure categories.

Variations Within Regions

As in the case of historical capital outlays, there is considerable variation within the regions in estimates of needs and revenues.

The table below shows the estimates of average annual per capita need by function and by region. In addition, the table indicates the range of the estimates given within each region.

TABLE 4.31.—SUMMARY OF ANNUAL PER CAPITA NEEDS BY REGION

Category	Northeast	Midwest	South	South-Central	West
Highways:					
Average	$112	$257	$181	$203	$129
Range	77–154	218–309	84–279	185–227	90–199
Other Transportation:					
Average	$65	$16	$33	$3	$28
Range	13–126	8–21	3–188	2–3	6–66
Sewerage:					
Average	$65	$59	$19	$17	$34
Range	44–86	35–91	9–47	6–32	8–89
Water:					
Average	$19	$19	$11	$44	$31
Range	11–24	N/A	5–19	19–68	5–59
Total:					
Average	$262	$351	$245	$266	$222
Range	239–363	N/A	109–380	N/A	167–258

The data show certain regional differences but also underscore the importance of regional variability. For example, the average per capita total needs for the South are among the highest at $245 per capita. Yet, the second highest as well as lowest per capita state estimates are included in the South.

The size of the sample for each region should be recognized when interpreting the projections as well. For example, in the South-Central region and in the Midwest, only three states are used to develop regional need estimates. In these as well as other regions, missing data preclude developing regional aggregate need estimates with any degree of confidence. As a result, it is helpful to evaluate the data on a state-by-state basis.

Variations Among the States

Table 4.32 ranks the participating states according to their projected per capita capital investment needs over the 1983 to 2000 period.

Total needs. Total needs for highways, sewerage and water are projected to average about $271 per capita over the 1983 to 2000 period. Twelve of the 23 states project requirements per capita ranging between $225 and $325.

The highest projection is for Indiana at $405 per capita. Indiana, a state from the Midwest, is followed by Alabama from the South, New York from the Northeast, Kentucky from the South, and Ohio from the Midwest. The Midwest, represented by only these three states in this study, claims three of the "top" seven needed positions.

From the bottom of the distribution, regional diversity is also present. The smallest per capita need is projected for South Carolina. Florida, also from the South, is second from the bottom with New Mexico, a western state, being third from the bottom. Maine, from the Northeast, is fourth from the bottom.

Highways. The average projected per capita highway need is $168. Twelve of the 23 states projected needs to be between $100 and $200 per capita.

The state listing shows that a Midwestern state, Indiana, leads the ranking with a projected per capita need of $309. Indiana is followed by Kentucky and Tennessee from the South, and Louisiana.

On a per capita basis, the smallest per capita need is projected for Maine. Other states projecting relatively modest per capita highway needs include South Carolina, Massachusetts, California, and New Mexico.

Other transportation. The average per capita need, for the 21 states which projected other transportation capital requirements, is $33. Per capita need estimates range from a low of $2 to a high of $188. The greatest needs are projected for Alabama, New York, Massachusetts, Colorado, and New Jersey.

Sewerage. The average per capita sewage treatment need is estimated to be $36 with a range from a low of $5 to $88.

The greatest sewerage needs are found in Indiana. Indiana is followed closely by Massachusetts, Maine, Washington, and Oregon. These five states project needs to be from $60 to $88 per capita. The inclusion of Washington and Oregon near the top is interesting since, on a regional basis, the greatest needs appear to be in the Northeast and Midwest.

On the bottom of the ranking, the smallest requirements are forecast for Okalahoma, Montana, Florida, Alabama and New Mexico.

TABLE 4.32.—RANKING (HIGHEST TO LOWEST) OF STATES ACCORDING TO REAL ANNUAL PER CAPITA NEEDS, 1983 TO 2000, BY FUNCTIONAL CATEGORY

Rank	Highways		Other transportation		Sewerage		Water		Subtotal	
	State	Per capita need	State	Per capita need	State	Per capita need	State	Per capita need	State	Per capita need
1	Indiana	309	Alabama	188	Indiana	88	Oklahoma	68	Indiana	405
2	Kentucky	279	New York	126	Massachusetts	81	Oregon	59	Alabama	380
3	Tennessee	273	Massachusetts	80	Maine	79	New Mexico	44	New York	363
4	Ohio	244	Colorado	66	Washington	73	Colorado	30	Kentucky	344
5	Louisiana	227	New Jersey	41	Oregon	60	California	28	Ohio	321
6	Missouri	218	California	31	New York	58	New York	24	Tennessee	314
7	Montana	199	Oregon	23	Ohio	56	New Jersey	22	Missouri	289
8	Oklahoma	197	Ohio	21	New Jersey	44	Kentucky	19	Oklahoma	272
9	Maryland	194	Missouri	19	Kentucky	42	Missouri	19	Louisiana	258
10	Texas	185	Maryland	17	California	34	Texas	19	Oregon	258
11	Alabama	166	New Mexico	14	Missouri	34	Washington	19	Massachusetts	257
12	North Carolina	162	Maine	13	Louisiana	28	North Carolina	16	Colorado	252
13	New York	154	North Carolina	9	Tennessee	22	Tennessee	13	Maryland	239
14	Colorado	138	Indiana	8	Maryland	20	Alabama	12	New Jersey	239
15	Washington	135	Florida	6	Colorado	18	Massachusetts	11	Washington	227
16	New Jersey	132	Montana	6	Texas	18	Maryland	8	Texas	222
17	Oregon	116	Tennessee	6	North Carolina	15	South Carolina	7	Montana	218
18	Florida	111	Kentucky	4	South Carolina	15	Florida	5	North Carolina	202
19	New Mexico	96	Louisiana	3	Alabama	13	Montana	5	California	184
20	California	90	South Carolina	3	New Mexico	13	Indiana	N/A	Maine	169
21	Massachusetts	86	Oklahoma	2	Florida	7	Louisiana	N/A	New Mexico	167
22	South Carolina	84	Texas	N/A	Montana	7	Maine	N/A	Florida	129
23	Maine	77	Washington	N/A	Oklahoma	5	Ohio	N/A	South Carolina	109
	Average	168		33		36		23		271

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TABLE 4.33.—PROJECTED CAPITAL OUTLAYS AND REVENUE FOR HIGHWAYS AND BRIDGES

	Population (thousands)			1983–2000 average annual (millions of 1982 dollars)			1983–2000 per capita annual (based on 1990 population)			Revenue as percent of needs
	1980	1990	2000	Capital outlay	Revenue	Gap	Capital outlay	Revenue	Gap	
State:										
Alabama	3,890	4,214	4,415	699	486	213	166	115	51	69
California	23,669	27,526	30,613	2,486	1,260	1,225	90	46	45	51
Colorado	2,889	3,755	4,657	517	428	89	138	114	24	83
Florida	9,740	13,316	17,438	1,476	922	553	111	69	42	63
Indiana	5,490	5,679	5,679	1,756	1,192	564	309	210	99	68
Kentucky	3,661	4,074	4,400	1,135	475	660	279	117	162	42
Louisiana	4,204	4,747	5,160	1,076	990	85	227	209	18	92
Maine	1,125	1,229	1,308	95	95	0	77	77	0	100
Maryland	4,216	4,491	4,582	872	407	465	194	91	103	47
Massachusetts	5,737	5,704	5,490	489	340	149	86	60	26	70
Missouri	4,917	5,077	5,080	1,105	505	600	218	99	118	46
Montana	787	888	963	177	89	88	199	100	99	50
New Jersey	7,364	7,513	7,428	995	471	524	132	63	70	47
New Mexico	1,300	1,536	1,727	147	93	54	96	61	35	63
New York	17,557	16,457	14,990	2,533	1,914	619	154	116	38	76
North Carolina	5,874	6,473	6,868	1,048	767	281	162	119	43	73
Ohio	10,797	10,763	10,357	2,632	549	2,083	244	51	194	21
Oklahoma	3,025	3,503	3,945	689	428	261	197	122	75	62
Oregon	2,633	3,319	4,025	387	289	97	116	87	29	75
South Carolina	3,119	3,560	3,907	301	N/A	N/A	84	N/A	N/A	N/A
Tennessee	4,591	5,073	5,420	1,386	996	390	273	196	77	72
Texas	14,228	17,498	20,739	3,244	2,928	317	185	167	18	90
Washington	4,130	5,012	5,833	675	399	276	135	80	55	59
Region:										
Northeast	31,783	30,903	29,216	4,112	2,820	1,292	112	79	33	70
Midwest	21,204	21,519	21,116	5,492	2,246	3,246	257	120	137	47
South	35,091	41,201	47,030	6,915	N/A	N/A	181	N/A	N/A	N/A
South-Central	21,457	25,748	29,844	5,009	4,346	663	203	166	37	82
West	35,408	42,036	47,818	4,388	2,559	1,829	129	81	48	63

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TABLE 4.34.—PROJECTED CAPITAL OUTLAYS AND REVENUE FOR OTHER TRANSPORTATION (AIRPORTS, RAILROADS, PORTS, MASS TRANSIT)

	Population (thousands)			1983–2000 average annual (millions of 1982 dollars)			1983–2000 per capita annual (based on 1990 population)			Revenue as percent of needs
	1980	1990	2000	Capital outlay	Revenue	Gap	Capital outlay	Revenue	Gap	
State:										
Alabama	3,890	4,214	4,415	794	578	216	188	137	51	73
California	23,669	27,526	30,613	846	531	315	31	19	11	63
Colorado	2,889	3,755	4,657	247	114	133	66	30	36	46
Florida	9,740	13,316	17,438	80	46	34	6	3	3	57
Indiana	5,490	5,679	5,679	48	34	14	8	6	2	71
Kentucky	3,661	4,074	4,400	16	16	0	4	4	0	98
Louisiana	4,204	4,747	5,160	16	15	1	3	3	0	92
Maine	1,125	1,229	1,308	16	8	9	13	6	7	48
Maryland	4,216	4,491	4,582	78	63	15	17	14	3	81
Massachusetts	5,737	5,704	5,490	454	79	375	80	14	66	17
Missouri	4,917	5,077	5,080	95	36	59	19	7	12	38
Montana	787	888	963	5	4	1	6	5	1	80
New Jersey	7,364	7,513	7,428	310	183	127	41	24	17	59
New Mexico	1,300	1,536	1,727	22	11	11	14	7	7	48
New York	17,557	16,457	14,990	2,072	782	1,290	126	48	78	38
North Carolina	5,874	6,473	6,868	57	4	53	9	1	8	7
Ohio	10,797	10,763	10,357	228	51	176	21	5	16	22
Oklahoma	3,025	3,503	3,945	7	N/A	N/A	2	N/A	N/A	N/A
Oregon	2,633	3,319	4,025	76	56	19	23	17	6	75
South Carolina	3,119	3,560	3,907	10	N/A	N/A	3	N/A	N/A	N/A
Tennessee	4,591	5,073	5,420	29	25	4	6	5	1	86
Texas	14,228	17,498	20,739	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Washington	4,130	5,012	5,833	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Region:										
Northeast	31,783	30,903	29,216	2,852	1,052	1,800	65	23	42	35
Midwest	21,204	21,519	21,116	370	121	249	16	6	10	37
South	35,091	41,201	47,030	1,065	N/A	N/A	33	N/A	N/A	N/A
South-Central	21,457	25,748	29,844	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West	35,408	42,036	47,818	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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TABLE 4.35.—PROJECTED CAPITAL OUTLAYS AND REVENUE FOR SEWERAGE TREATMENT

	Population (thousands)			1983–2000 average annual (millions of 1982 dollars)			1983–2000 per capita annual (based on 1990 population)			Revenue as percent of needs
	1980	1990	2000	Capital outlay	Revenue	Gap	Capital outlay	Revenue	Gap	
State:										
Alabama	3,890	4,214	4,415	56	43	12	13	10	3	78
California	23,669	27,526	30,613	943	592	352	34	21	13	63
Colorado	2,889	3,755	4,657	68	37	32	18	10	8	54
Florida	9,740	13,316	17,438	88	49	40	7	4	3	55
Indiana	5,490	5,679	5,679	500	375	125	88	66	22	75
Kentucky	3,661	4,074	4,400	171	81	89	42	20	22	48
Louisiana	4,204	4,747	5,160	134	N/A	N/A	28	N/A	N/A	N/A
Maine	1,125	1,229	1,308	97	12	85	79	10	69	13
Maryland	4,216	4,491	4,582	89	181	−92	20	40	−20	202
Massachusetts	5,737	5,704	5,490	461	130	332	81	23	58	28
Missouri	4,917	5,077	5,080	171	77	95	34	15	19	45
Montana	787	888	963	6	6	0	7	7	0	100
New Jersey	7,364	7,513	7,428	327	202	125	44	27	17	62
New Mexico	1,300	1,536	1,727	20	5	15	13	3	10	25
New York	17,557	16,457	14,990	961	811	150	58	49	9	84
North Carolina	5,874	6,473	6,868	99	77	22	15	12	3	78
Ohio	10,797	10,763	10,357	604	492	111	56	46	10	82
Oklahoma	3,025	3,503	3,945	17	1	16	5	0	4	7
Oregon	2,633	3,319	4,025	200	111	89	60	33	27	56
South Carolina	3,119	3,560	3,907	55	50	5	15	14	1	91
Tennessee	4,591	5,073	5,420	110	59	50	22	12	10	54
Texas	14,228	17,498	20,739	317	N/A	N/A	18	N/A	N/A	N/A
Washington	4,130	5,012	5,833	368	135	233	73	27	47	37
Region:										
Northeast	31,783	30,903	29,216	1,846	1,155	691	65	27	38	42
Midwest	21,204	21,519	21,116	1,275	944	331	59	42	17	71
South	35,091	41,201	47,030	667	540	127	19	16	3	83
South-Central	21,457	25,748	29,844	467	N/A	N/A	17	N/A	N/A	N/A
West	35,408	42,036	47,818	1,606	885	721	34	17	17	49

Dec. 22, 1983.

TABLE 4.36.—PROJECTED CAPITAL OUTLAYS AND REVENUE FOR WATER SUPPLY, TREATMENT AND DISTRIBUTION

	Population (thousands)			1983–2000 average annual (millions of 1982 dollars)			1983–2000 per capita annual (based on 1990 population)			Revenue as percent of needs
	1980	1990	2000	Capital outlay	Revenue	Gap	Capital outlay	Revenue	Gap	
State:										
Alabama	3,890	4,214	4,415	51	N/A	N/A	12	N/A	N/A	N/A
California	23,669	27,526	30,613	780	293	486	28	11	18	38
Colorado	2,889	3,755	4,657	112	112	0	30	30	0	100
Florida	9,740	13,316	17,438	70	70	0	5	5	0	100
Indiana	5,490	5,679	5,679	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kentucky	3,661	4,074	4,400	79	75	4	19	18	1	94
Louisiana	4,204	4,747	5,160	N/A	17	N/A	N/A	4	N/A	N/A
Maine	1,125	1,229	1,308	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maryland	4,216	4,491	4,582	35	96	−61	8	21	−14	274
Massachusetts	5,737	5,704	5,490	64	17	47	11	3	8	27
Missouri	4,917	5,077	5,080	94	34	60	19	7	12	36
Montana	787	888	963	5	1	4	5	1	5	16
New Jersey	7,364	7,513	7,428	167	106	61	22	14	8	63
New Mexico	1,300	1,536	1,727	67	67	0	44	44	0	100
New York	17,557	16,457	14,990	400	203	197	24	12	12	51
N. Carolina	5,874	6,473	6,868	102	94	8	16	14	1	92
Ohio	10,797	10,763	10,357	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oklahoma	3,025	3,503	3,945	239	N/A	N/A	68	N/A	N/A	N/A
Oregon	2,633	3,319	4,025	194	94	100	59	28	30	49
S. Carolina	3,119	3,560	3,907	24	24	0	7	7	0	100
Tennessee	4,591	5,073	5,420	67	N/A	N/A	13	N/A	N/A	N/A
Texas	14,228	17,498	20,739	333	N/A	N/A	19	N/A	N/A	N/A
Washington	4,130	5,012	5,833	96	96	0	19	19	0	100
Region:										
Northeast	31,783	30,903	29,216	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Midwest	21,204	21,519	21,116	N/A	N/A	N/A	N/A	N/A	N/A	N/A
South	35,091	41,201	47,030	428	N/A	N/A	11	N/A	N/A	N/A
South-Central	21,457	25,747	29,844	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West	35,408	42,036	47,818	1,255	665	590	31	22	9	72

Dec. 22, 1983.

TABLE 4.37.—PROJECTED CAPITAL NEEDS AND REVENUE FOR TOTAL INFRASTRUCTURE (TRANSPORTATION, SEWER AND WATER)

	Population (thousands)			1983–2000 average annual (millions of 1982 dollars)			1983–2000 per capita annual (based on 1990 population)			Revenue as percent of needs
	1980	1990	2000	Capital needs	Revenue	Gap	Capital needs	Revenue	Gap	
State:										
Alabama	3,890	4,214	4,415	1,600	N/A	N/A	380	N/A	N/A	N/A
California	23,669	27,526	30,613	5,055	2,676	2,378	184	97	86	53
Colorado	2,889	3,755	4,657	944	691	254	252	184	68	73
Florida	9,740	13,316	17,438	1,714	1,086	627	129	82	47	63
Indiana	5,490	5,679	5,679	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kentucky	3,661	4,074	4,400	1,401	647	754	344	159	185	46
Louisiana	4,204	4,747	5,160	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maine	1,125	1,229	1,308	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maryland	4,216	4,491	4,582	1,074	747	327	239	166	73	70
Massachusetts	5,737	5,704	5,490	1,468	565	902	257	99	158	39
Missouri	4,917	5,077	5,080	1,465	652	813	289	128	160	44
Montana	787	888	963	193	N/A	N/A	218	N/A	N/A	N/A
New Jersey	7,364	7,513	7,428	1,799	962	837	239	128	111	53
New Mexico	1,300	1,536	1,727	256	176	80	167	115	52	69
New York	17,557	16,457	14,990	5,967	3,710	2,257	363	225	137	62
North Carolina	5,874	6,473	6,868	1,305	921	384	202	142	59	71
Ohio	10,797	10,763	10,357	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oklahoma	3,025	3,503	3,945	952	N/A	N/A	272	N/A	N/A	N/A
Oregon	2,633	3,319	4,025	856	551	305	258	166	92	64
South Carolina	3,119	3,560	3,907	389	N/A	N/A	109	N/A	N/A	N/A
Tennessee	4,591	5,073	5,420	1,592	N/A	N/A	314	N/A	N/A	N/A
Texas	14,228	17,498	20,739	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Washington	4,130	5,012	5,833	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Region:										
Northeast	31,783	30,903	29,216	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Midwest	21,204	21,519	21,116	N/A	N/A	N/A	N/A	N/A	N/A	N/A
South	35,091	41,201	47,030	9,074	N/A	N/A	245	N/A	N/A	N/A
South-Central	21,457	25,748	29,844	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West	35,408	42,036	47,818	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Dec. 27, 1983.

TABLE 4.38.—PROJECTED PER CAPITA CAPITAL NEEDS, REVENUE AND REVENUE SHORTFALL BY REGION (THE REGIONAL AVERAGES ARE WEIGHTED BY STATE POPULATION)

Region and State	Population (thousands) 1990	Projected average annual per capita capital need (1983–2000)					Projected average annual per capita revenue (1983–2000)					Projected average annual per capita gap (1983–2000)				
		Highways	Other	Sewerage	Water	Subtotal	Highways	Other	Sewerage	Water	Subtotal	Highways	Other	Sewerage	Water	Subtotal
Northeast:																
Maine	1,229	77	13	79	N/A	N/A	77	6	10	N/A	N/A	0	7	69	N/A	N/A
Massachusetts	5,704	86	80	81	11	257	60	14	23	3	99	26	66	58	8	158
New Jersey	7,513	132	41	44	22	239	63	24	27	14	128	70	17	17	8	111
New York	16,457	154	126	58	24	363	116	48	49	12	225	38	78	9	12	137
Average		133	92	60	21	306	91	34	37	11	174	42	58	22	10	133
Midwest:																
Indiana	5,679	309	8	88	N/A	N/A	210	6	66	N/A	N/A	99	2	22	N/A	N/A
Missouri	5,077	218	19	34	19	289	99	7	15	7	128	118	12	19	12	160
Ohio	10,763	244	21	56	N/A	N/A	51	5	46	N/A	N/A	194	16	10	N/A	N/A
Average		255	17	59	19	350	104	6	44	7	161	151	12	15	12	190
South:																
Alabama	4,214	166	188	13	12	380	115	137	10	N/A	N/A	51	51	3	N/A	N/A
Florida	13,316	111	6	7	5	129	7	3	4	5	19	104	3	3	0	109
Kentucky	4,074	279	4	42	19	344	117	4	20	18	159	162	0	22	1	185
Maryland	4,491	194	17	20	8	239	91	14	40	21	166	103	3	−20	−14	73
North Carolina	6,473	162	9	15	16	202	119	1	12	11	142	43	8	3	4	59
South Carolina	3,560	84	3	15	7	109	N/A	N/A	14	7	N/A	N/A	N/A	1	0	N/A
Tennessee	5,073	273	6	22	13	314	196	5	12	N/A	N/A	77	1	10	N/A	N/A
Average		134	25	14	9	182	59	23	12	11	105	75	2	2	−2	77
South-Central:																
Louisiana	4,747	227	3	28	N/A	N/A	209	3	N/A	4	N/A	18	0	N/A	N/A	N/A
Oklahoma	3,503	197	2	5	68	272	122	N/A	0	N/A	N/A	75	N/A	4	N/A	N/A
Texas	17,498	185	N/A	18	19	N/A	167	N/A	N/A	N/A	N/A	18	N/A	N/A	N/A	N/A
Average		195	3	18	27	243	169	3	0	4	176	26	0	18	24	67
West:																
California	27,526	90	31	34	28	184	46	19	21	11	97	45	11	13	18	86
Colorado	3,755	138	66	18	30	252	114	30	10	30	184	24	36	8	0	68
Montana	888	199	6	7	5	218	100	5	7	1	113	99	1	0	5	105
New Mexico	1,536	96	14	13	44	167	61	7	3	44	115	35	7	10	0	52
Oregon	3,319	116	23	60	59	258	87	17	33	28	166	29	6	27	30	92
Washington	5,012	135	N/A	73	19	N/A	80	N/A	27	19	N/A	55	N/A	47	0	N/A
Average		104	32	38	30	205	61	16	21	16	114	44	16	17	14	91

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Water. Nineteen of the 23 case-study states were able to develop projections of water needs. The average per capita need is $23.

Western states dominate the water needs category. The top ranked states Oklahoma, followed by Oregon, New Mexico, Colorado and California. These five states show needs of between $28 and $68 per capita.

Four states project needs to be less than $10 per capita. These include Montana, Florida, South Carolina and Maryland.

Tables 4.33, 4.34, 4.35, 4.36 and 4.37 show investment needs by function and state.

A Methodological Comment—Weighted Averages

Throughout this analysis, regional comparisons have been made using simple averages. That is, for instance, the per capita needs for Montana are viewed as equal to the per capita needs of California. This approach was taken so that very populous states such as California or New York would not dominate the regional figures.

At the same time, regional need and revenue figures can be derived which are weighted by state populations. These weighted means will be more dependent upon the projections developed by the most populous states.

Table 4.38 shows the impact of using weighted means. (This table is comparable to Table 4.30 which developed simple means.) A comparision of simple and weighted means by region is shown below.

TABLE 4.39.—A COMPARISON OF REGIONAL AVERAGE ANNUAL PER CAPITA NEEDS FOR HIGHWAY, OTHER TRANSPORTATION, SEWERAGE AND WATER

Region	Simple mean	Weighted mean
Northeast	$262	$306
Midwest	351	350
South	245	182
South-Central	266	243
West	22	205

Summary: Projected Infrastructure Needs

The examination of future infrastructure needs and revenues indicates:

There are regional variations in terms of infrastructure needs. These variations are greatest when examining various components of infrastructure as opposed to total infrastructure needs.

The greatest regional per capita infrastructure needs are projected for the Midwest. The region forecasting the smallest total requirements is the West. The Northeast, South and South-Central project total needs of similar magnitudes.

All regional project future needs to be greatly in excess of historical expenditure levels. In the Midwest, future per capita needs are triple recent levels of capital expenditure.

All regions expect revenue to be insufficient to meet future infrastructure demand with annual per capita revenue shortfalls ranging from $82 to $176 for funding highways, other transportation, water and sewerage systems.

The single most dominant need across the country is highways and bridges. Total capital needs for this infrastructure component for the 23 case-study states were estimated to be $466 billion, or 62 percent of the combined needs for highways, water and sewerage systems. Assuming the same per capita relationship holds for other states throughout the country, total highway needs are projected to be $720 billion over the 1983 to 2000 period in 1982 dollars.

On a regional basis, the greatest highway needs are projected for the Midwest. Per capita needs in the Midwest are projected to be $257, or 281 percent more than recent levels of capital outlays for highways.

Total sewerage treatment needs are projected to be $106 billion in the case-study states, or $163 billion nationally in 1982 dollars. The greatest needs are projected for the Northeast and Midwest. The per capita requirements in these two regions are substantially larger than their recent expenditure levels and about triple the needs of the South and South-Central.

Water needs are projected to be $62 billion in the case-study states, or $96 million nationally in 1982 dollars. Water is predominantly a concern of the West and South-Central regions where per capita needs are projected to be $44 and $31 respectively. Other regions show needs to be less than $20 per capita.

Other transportation (i.e., ports, airports, railroads, mass transit) is a vital infrastructure component, but one in which the private sector has traditionally played a major role. Projected other transportation needs varied greatly from $3 per capita in the South-Central to $65 per capita in the Northeast. This variation is largely attributable to the relative importance to the various states and regions as well as the lack of data availability.

Chapter 5. THE FEDERAL ROLE IN INFRASTRUCTURE DEVELOPMENT

Most of the nation's basic public infrastructure—its roads, bridges, airports, water supply, sewage systems and treatment capacity—were put in place by state and local governments. The federal role, however, has been a substantial one. It has served as financier, standard setter and definer of needs.

This chapter sketches out the federal role in the development of basic infrastructure. It identifies expected and potential changes in that role attributable to implementation of President Reagan's New Federalsim philosphy. President Reagan wants to see a major reduction in the size and reach of the federal government, with a shift of responsibility either to state and local government or the private sector.

RATIONALES FOR FEDERAL INVOLVEMENT

The federal government has justified its involvement in public on several grounds.

1. *Promotion of interstate commerce.* Article 1 Section 8 of the Constitution gives Congress the power to regulate commerce among the states. Based on this power and in the interest of economic development and nation building, the federal government has invested many dollars in the construction of basic infrastructure. Federal interest in the development of infrastructure started early in the nation's history with Congress engaging in lengthy debates over the need for "internal improvements" to develop manufacturing and open the West to development. Over the years, the federal government has undertaken projects directly (as in river and harbor improvements), subsidized the private sector (e.g. through land grants to the railroads) or made grants to state and local governments (e.g. grants for airport construction).[1]

2. *Providing for national defense.* Often public projects have been justified as contributing to the nation's defense. In the early years of the republic, the military needed to be able to patrol all parts of the country and hence the government sponsored exploration, land surveys and the construction of roads. In more recent times, it was the National Defense Highway Act that authorized grants for interstate highway construction.

3. *Job creation/management of the economy.* A major expansion of the federal role in public works came during the New Deal when the federal government sought to provide jobs to the unemployed and pick up the slack created when state and local governments re-

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[1] For a history of federal involvement in the development of infrastructure, see Mark Aldrich, "A History of Public Works in the United States 1790-1970" Appendix F in CONSAD Research Corp., "A Study of Public Works investment in the United States;" reprint prepared for the U.S. Department of Commerce, April 1980.

sponded to the Depression by cutting back on expenditures, especially for capital purposes. Through the WPA, Reconstruction Finance Corp., etc., the federal government helped finance the building or roads, bridges, sewers, waterworks, docks, wharves, airports, hospitals and public buildings of all sorts. It also undertook major waterway development projects (including projects of the TVA, the Hoover and Bonnieville dams) for purpose of irrigation, flood control and electicity generation. The Depression experience established the precendent of using public works as a counter-cyclical tool. Anti-recession public works programs were again initiated in the sixties and seventies and were used to a more limited extent during the current economic slowdown.

4. *Correction of externalities/reimbursement of mandates.* In recent years, the federal government has devoted significant resources to the building of wastewater collection and treatment systems. The investment is intended to help local governments comply with discharge standards put in place to achieve federal water quality goals. The federal role in this area expanded gradually. it came about because citizens of one state were helpless in the face of pollution created in another state, expecially if the latter state was unwilling to join in the pollution control efforts.

While the externalities argument is most apparent in the case of air pollution, it also undergirds investment in the transportation area. If one state fails to invest in roadways, then the investments in surrounding states are less valuable since they do not allow through transit.

5. *Protection of health and welfare.* In some instances, the major justification for federal involvement is simply that a project contributes to the safety or wellbeing of the populace and that the federal government had the resources and political constituency required to act.

FEDERAL ROLE IN DEVELOPMENT OF INFRASTRUCTURE

The federal government plays two basic roles in the development of infrastructure. First, it helps finance the construction, repair or rehabilitation of specific components of the public capital plant. Second, it frequently sets the standards which define "needs" and which guide type and method of construction. The federal government's policies also have an indirect effect on infrastructure needs and state and local governments' response. A range of tax and expenditure policies influence the investment and location choices of both individuals and businesses. Fiscal and monetary policy affect interest rates and price inflation.

Federal Government as Financier

While the federal government has assumed direct responsibility for the construction or operation of certain types of capital facilities, its primary role has been to subsidize state and local government capital investment. It does this directly through grant programs and, indirectly, by subsidizing state and local government borrowing (through the exemption of interest earnings from federal income tax). The magnitude of these roles, as reflected in dollar commitments, is shown in Table 6.1.

Direct federal investment. Direct investment in fixed capital assets has primarily been for defense installations and weapon systems. These investments which have increased from $17.8 billion in 1962 to $48.8 billion in 1982, have constituted over 80 percent of total federal direct investment in capital assets since World War II.

Federal direct involvement in the building of infrastructure for non-defense purposes has been primarily in the area of water resource development and energy facilities. The Army Corps of Engineers, the Bureau of Reclamation and the various federal power administrations account for the great bulk of direct capital spending by the federal government (see Table 5.2).

TABLE 5.1.—FEDERAL INVESTMENT IN INFRASTRUCTURE

[In billions of dollars]

Fiscal year	Direct capital investment for nondefense purposes	Grants to State and local government	Indirect aid via tax exemption of interest earned on municipal bonds [1]
1952	1.5	0.6	([2])
1960	1.9	3.3	([2])
1965	3.0	5.0	([2])
1970	2.5	7.0	([2])
1971	3.0	7.9	([2])
1972	3.6	8.4	([2])
1973	3.7	8.8	([2])
1974	4.0	9.8	([2])
1975	4.8	10.8	3.8
1976	5.2	13.5	4.4
1977	5.8	16.1	4.8
1978	6.6	18.3	4.8
1979	7.3	20.0	5.4
1980	7.7	22.4	4.9
1981	8.4	22.1	6.1
1982	8.5	20.2	6.9
1983 (estimated)	8.7	20.3	
1984 (proposed)	7.8	23.7	
Average Annual Percentage Change			
1952 to 1960	3.0	23.8	
1960 to 1970	2.8	7.8	
1970 to 1978	12.9	12.8	
1978 to 1984	2.8	4.4	
Average Percentage Change After Inflation			
1952 to 1960	1.0	22.9	
1960 to 1970	.7	4.7	
1970 to 1978	5.8	3.7	
1978 to 1984	−5.2	−3.3	

[1] This is the estimate of revenues foregone by the federal government as a result of the provision excluding interest on general obligation bonds from the income tax. The actual savings to state and local governments is somewhat less as the subsidy mechanism is relatively inefficient with some of the benefit going to the highest income taxpayers.

[2] Tax expenditures were not calculated until 1975.

Sources: Office of Management and Budget, Federal Outlays for Major Physical Capital Investment February 1983 (unpublished tables); Office of Management and Budget "Tax Expenditures," Special Analysis Budget of the U.S. Government, various years.

Federal grants in aid. Responsibility for building and maintaining almost all components of the public capital plant rests with state and local government. Their capital spending increased rapidly in the fifties and early sixties as state and local governments built schools to accommodate the baby boom and engaged in construction of the interstate highway system. By the late sixties, spending slowed as priorities shifted to the human and social service programs. By the latter part of the seventies, there was an overall retrenchment in state and local budgets, affecting both capital investment and service-oriented programs. Capital spending seems to have picked up since 1980 (see Table 5.3).

While state and local expenditures for capital declined in real terms, federal financial assistance to them for this purpose increased. Grants in aid for capital investment purposes increased from $1.1 billion in 1957 to a peak of $22.5 billion in 1980. When inflation is taken into account, however, capital grant outlays peaked in 1978 and have decreased by roughly a quarter between 1978 and 1983. In the sixties, federal grants went largely for the construction of the interstate highway system. By the seventies, the federal govenment had expanded its aid for other elements of the transportation network. More importantly, it had made a major commitment to the construction of wastewater treatment plants so as to help municipalities comply with discharge standards and help the nation move towards its goal of fishable and swimmable waters. There as also a sizable commitment made to community development programs, although these funds are not used exclusively for capital purposes.

This reallocation of funds among functions were in part responsible for a shift in the pattern of funds distributed towards older and more urban parts of the country.[2] Even within the highway program, the geographic pattern of funds distrubution shifted somewhat as major urban arterials were included in the federal aid system.

Initially most federal grants for capital purposes were limited to the construction of new facilities (see Table 5.4). State and local governments were expected to finance operations, repair and rehabilitation with their own funds. Given the incentives implicit in the federal grant programs and the penchant of politicians for ribbon-cutting, state and local investments were directed towards additions to capital plant rather than maintenance and repair of existing facilities. As the consequences of this pattern of investment became apparent, changes were made in some of the federal grant programs to allow the use of funds for and encourage maintenance, repair and rehabilitation activities. Most notable were the addition of 3R work in the highway program and the passage of Section 5 operating assistance for transit.

Indirect financial assistance. The federal government also provides support for the development of infrastructure in an indirect way—through provisions of the tax code exempting interest earned on state and local bonds from the individual and corporate income tax. Because bondholders gain a tax advantage, state and local governments can borrow funds at rates substantially below those available in private capital markets.

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[2] George Peterson and Mary John Miller, *Financing Public Infrastructure: Policy Options.* An Information Bulletin of the Community and Economic Development Tark Force Public Technology Incorporated, Washington D.C., 1982.

TABLE 5.2.—DIRECT CAPITAL INVESTMENT BY THE FEDERAL GOVERNMENT

[In billions of dollars]

	1962	1967	1972	1977	1978	1979	1980	1981	1982	1983	1984 (estimate)
Defense	17.8	21.4	19.1	21.6	23.2	29.0	33.0	39.6	48.8	61.8	76.7
Water and power projects:											
Corps of Engineers	.8	1.1	1.1	1.4	1.5	1.7	1.8	1.6	1.6	1.4	1.0
Bureau of Reclamation	.3	.2	.2	.6	.5	.5	.6	.6	.6	.6	.7
Other	1.2	.3	1.8	1.8	2.2	2.6	2.2	2.7	2.1	2.4	2.4
Other construction or rehabilitation	.8	1.2	1.3	1.4	1.9	2.0	2.5	2.6	2.6	2.7	2.8
Acquisition of major equipment	.2	.2	.2	.4	.4	.7	.7	1.0	1.3	1.6	.8

Source: U.S. Office of Management and Budget, Federal Outlays for Major Physical Capital Investment 1984 Budget Data, February 1983 (unpublished tables).

TABLE 5.3.—CAPITAL OUTLAYS BY STATE AND LOCAL GOVERNMENTS

Fiscal year	Highways and bridges	Transit	Air transportation	Sewer	Water supply	Total these functions	Local schools	All others	Total capital outlays
Spending in millions									
1952	2,700	67	49	442	406	3,664	1.421	2,351	7,436
1960	6,340	94	243	767	843	8,287	2,903	3,914	15,104
1965	8,324	242	261	1,107	1,138	11,072	3,287	6,176	20,535
1970	10,762	366	691	1,385	1,201	14,405	4,658	10,587	29,650
1971	11,888	446	734	1,744	1,247	16,059	4,845	12,233	33,137
1972	12,317	435	906	2,091	1,343	17,092	4,759	12,776	34,627
1973	11,459	920	1,011	2,428	1,435	17,243	4,856	13,173	35,272
1974	12,152	926	812	2,640	1,743	18,273	5,108	14,703	38,084
1975	13,646	1,203	852	3,569	2,111	21,381	6,532	16,911	44,824
1976	14,209	1,339	802	3,955	2,208	22,513	6,547	17,471	46,531
1977	12,497	1,573	599	4,208	2,302	21,179	5,982	23,393	45,154
1978	12,898	1,407	777	4,366	2,141	21,589	5,709	17,471	44,769
1979	15,567	1,618	966	5,619	2,701	26,471	6,370	20,335	53,196
1980	19,133	1,921	1,391	6,272	3,335	32,052	7,362	23,480	62,894
1981	19,334	2,617	1,438	6,911	3,784	34,084	7,441	26,071	67,596
Average Annual Percentage Change in Nominal Dollars									
1952 to 1960	11.3	4.3	22.2	7.1	9.6	10.7	9.3	6.6	9.3
1960 to 1970	5.4	14.6	11.0	6.1	3.6	5.7	4.8	10.5	7.0
1970 to 1978	2.3	18.3	1.5	15.4	7.5	5.2	2.6	6.5	5.3
1978 to 1981	14.4	22.9	22.8	16.5	20.9	16.4	9.2	14.3	14.7
Average Annual Percentage Change Corrected for Inflation [1]									
1952 to 1960	8.5	1.8	19.1	4.5	6.9	8.1	6.6	4.0	6.7
1960 to 1970	3.5	12.5	9.0	4.2	1.7	3.8	2.9	8.6	5.1
1970 to 1978	−4.2	10.9	−4.9	8.1	.7	−2.2	−3.9	−.8	−2.0
1978 to 1981	5.4	13.3	13.1	7.4	11.4	7.2	.1	5.3	5.7

[1] Capital outlays were deflated using the special GNP deflator for gross private domestic fixed investment for non-residential purposes.

Source: Expenditure Data from U.S. Bureau of the Census, Government finances various years. Deflator from Economic Report of the President, January 1981.

TABLE 5.4—MAJOR FEDERAL GRANT OUTLAYS FOR CAPITAL PURPOSES

[In billions of dollars]

	Selected years										
	1962	1967	1972	1977	1978	1979	1980	1981	1982	1983	1984
Highways	2.8	4.0	4.6	5.9	5.9	7.1	9.0	8.8	7.7	8.5	11.8
Mass transit	0	([1])	.3	1.3	1.4	1.7	2.0	2.6	2.6	2.8	3.1
Airports	.1	.1	.1	.3	.6	.6	.6	.5	.3	.5	.7
Community and regional development	.2	.5	2.3	3.6	3.4	4.4	5.1	5.4	5.1	4.8	4.6
Countercyclical public works	0	([1])	([1])	.6	3.1	1.7	.4	.1	([1])	([1])	([1])
Pollution control facilities	([1])	.1	.4	3.5	3.2	3.8	4.3	3.9	3.8	3.1	2.8
Other natural resources	([1])	.1	.2	.4	.4	.5	.6	.6	.3	.3	.1
Other	.1	.4	.5	.5	.3	.3	.2	.2	.2	.3	.5
Total	3.2	5.2	8.4	16.2	18.3	20.0	22.4	22.1	20.1	20.3	23.6

[1] Less than $50 million.

Source: U.S. Office of Management and Budget, Federal Outlays for Major Physical Capital Investment 1984 Budget Data, February 1983 (unpublished tables).

The size of the federal subsidy provided in this fashion depends on a number of factors, most important of which are the total amount of state and local government borrowing, the prevailing interest rate and the spread between the typical interest rate on corporate bonds and the interest paid on similarly-rated municipal bonds. Most state and local borrowing is for capital purposes; therefore, the feds are supporting infrastructure development to the extent that its policies reduce borrowing costs and hence total project costs.

The spread in interest rates between tax-exempt and other bonds determines the federal subsidy per dollar borrowed by state and local governments. Recently, the spread has narrowed. There are many reasons why the terms on which state and local governments have been able to borrow have become less favorable. First, access to the tax-exempt market has been broadened. Pollution-control bonds, industrial revenue and mortgage revenue bonds—all issued essentially for private purposes—compete with more traditional general obligation and revenue bonds issued by state and local governments to fund public infrastructure. Second, the number of tax sheltered investment opportunities has expanded and marginal tax rates have been lowered, thereby reducing the need for taxpayers to invest funds in state and local bonds. Third, state and local governments have relied more heavily on revenue bonds than on general obligation bonds. Since these instruments are sometimes viewed as more risky, the borrowing rate is somewhat higher. Fourth, the fiscal crises that have beset some of the older cities have shaken investor's confidence in the safety of bonds. The perception of risk is further enhanced by the range of tax constraints voted by taxpayers and local officials over the last several years.

Federal Government as Standard Setter

The federal role is not limited to finances; it also sets many of the standards by which needs are defined. The standards are used to determine the type of facility or investment required under different circumstances, and the way facilities should be constructed.

Most of the standards are imposed via federal grant programs. In order to qualify for federal assistance, state and local governments have to engage in planing (sometimes in a regional context) and adhere to a wide range of design and procurement standards. Sometimes these standards or procedures are embraced by the states for broader application to their own construction program. For example, the federal highway administration sets standards for roads in the federal aid system, many of which are applied to off-system roads as well.

Sometimes the federal government sets standards for planning purposes rather than grants administration. The standards are used to define a national problem by assessing levels of need. They may also be used to allocate available federal funds. For example, the federal government does a needs assessment for airport facilities. It also sets standards for evaluating bridge deficiencies. When a grant program was set up to deal with the latter problem, funds were distributed among states based on the estimated cost of bringing all bridges up to the federal standard.

Some federal standards are imposed independent of federal grant programs. Federal clean water legislation passed in 1972 set as a goal the attainment of fishable and swimmable water by 1983. It set an interim deadline of 1977 at which time secondary treatment of all municipal wastewater was required to meet the standards set forth in the legislation. Massive investments in sewer improvements and sewage treatment were, and still are, required. While in this instance, the federal government committed itself to providing financial assistance, the legal requirement on states and localities to limit discharges of pollutants stands apart from the grant-in-aid process. Thus far, deadlines have been pushed back and the question of enforcing compliance has not fully been faced.

There are other instances of the federal government setting standards that define needs or establish design criteria independent of the federal grant process. For example, the Safe Drinking Water Act mandates inspection of all water supply systems and construction of treatment facilities if certain inpurities are found. The Resource Recovery Act prohibits ocean dumping of sewage sludge, thereby forcing jurisdictions that had relied on that practice to invest in new facilities to handle sludge. The Architectural Barriers Act requires all new public facilities to be accessible to the handicapped.

Federal Policy, Population Shifts and Infrastructure Investment

Investment in infrastructure is required both to replace and repair existing infrastructure and to accommodate the needs of growth. Since overall population in the U.S is relatively stable, investment needs attributable to growth in fact stem from the movements of people and business from older, existing communities to newer ones. Federal policy has led to an increase in these growth-related infrastructure costs by encouraging decentralization.[3] Various elements of policy are responsbile. For example, the combination of tax subsidies for homeownership and the FHA mortgage program led to increased building of single family homes in suburban locations. Federal investment in interstate highways allowed businesses to move further away from markets and railheads. "Federal tax laws favored investment in new structures over investment in repair, maintenance, preservation and upgrading of old structures." [4] They have thereby shortened replacement cycles and accelerated adjustments to other locations. In other words, because of the way the tax law was structured, businesses were more likely to invest in new plants and new plants were more likely to be in areas that require investment in infrastructure.

Summary: The Changing Federal Role

Federal involvement in infrastructure has greatly increased since World War II. Its level of financial support has grown and the availability of federal funds had shifted patterns of state and local investment among functional areas. Early emphasis within federal programs on new construction have been altered to some extent, so that rehabilitation and repair activities have become eligible for grant assistance. The federal role extended well beyond its grants, however. Through its laws establishing standards, it defined much of the capital investment agenda for states and localities. Also, a variety of tax and expenditure policies affected incentives in the marketplace and contributed to shifts in population and business activity responsible for some of the nation's infrastructure requirements.

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[3] See Roger J. Vaughan and Mary E. Vogel, "The Urban Impacts of Federal Policies: Vol. 4, Population and Residential Location, R and Corporation," R-2205-KF/HEW, Santa Monica, California: May, 1979.

[4] George Peterson, "Federal Tax Policy and Urban Development". Testimony before the Subcommittee on the City of the House Committee on Banking, Finance and Urban Affairs, June 16, 1977, Washington, D.C.: 1977.

NEW FEDERALISM

The term New Federalism has been used to describe both the philosophy and program of the Reagan administration. The goal has been to reduce the role of the federal government by identifying responsibilities that could be turned over to state and local governments or the private sector. While a clear sorting out of responsibilities has not been achieved, the administration has moved to reduce the federal role by cutting taxes, reducing the budget, and easing federal regulations.

Assessing the impact of New Federalism on infrastructure is somewhat difficult since the administration's proposals have not always been embraced by the Congress; indeed, faced with congressional resistance to its initial proposals, the administration has changed many of its own positions. The sum total of policy and program change is not always consistent with a New Federalism philosophy.

In the following section, major legislative, administrative and budgetary changes affecting the federal role in the development of infrastructure are described.

Federal Support for Highways

The federal government provides financial assistance to states and localities for the construction and rehabilitation of interstate primary, secondary and urban roads comprising the federal-aid system.[5] The federal aid system accounts for roughly one-fifth of the nation's total road mileage but accounts for 79 percent of vehicle miles traveled.[6] Federal funds are also available for the replacement or repair of deficient bridges and for projects which enhance highway safety.

Federal assistance for roads has been available for nearly 70 years. A crucial change in policy occurred in the 1950s, however, when Congress committed the nation to completion of a 41,000 mile interstate highway system and dedicated several revenue sources to a trust fund for use exclusively on highway construction. Through the late fities and early sixties, funding for the highway program increased as Congress maintained its commitment to completing the interstate system despite continued escalation in estimated project costs.[7]

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[5] The interstate system "consists of routes of highest importance to the nation that connect, as directly as possible, the principal metropolitan areas, cities and industrial centers including important routes into, through and around urban areas." It is a subsystem of the primary system. The federal-aid primary system "consists of a system of interconnected main roads important to interstate, statewide and regional travel, consisting of rural arterial routes and their extensions into or through urban areas." The secondary system consists of major rural collection routes and the urban system consists of urban arterial and collection routes. See Report of the Secretary of Transportation to the U.S. Congress, "Status of the Nation's Highways: Conditions and Performance," Washington D.C., 1981 p. 8.

[6] U.S. General Accounting Office, "Deteriorating Highways and Lagging Revenues: A Need to Reassess the Federal Highway Program," CED-810-42, Washington D.C., March 5, 1981, p. 2.

By the mid-seventies, two major problems affecting the highway program were identified. First, the condition of many of the nation's highways was deteriorating and the federal aid program, with its emphasis on new construction, was not helpful in reversing the trend.[8] Congress responded in 1974 by amending the program to allow the use of funds for resurfacing, restoration and rehabilitation and in 1976 set aside trust fund money explicitly for this purpose.

The second problem which emerged during the seventies was that the price of highway construction was rising much more rapidly than available revenues. The highway trust fund receives most of its revenue from a tax imposed on gasoline consumption. While the rate of tax (4¢ per gallon) was fixed, revenues grew during the fifties and sixties as Americans increased their use of autos and of gasoline. With the energy crisis of the seventies, gas prices rose markedly and tax revenues declined as Americans shifted to smaller, more fuel-efficient automobiles and limited their auto travel. Since the tax was levied on a fixed rather than proportional basis, collections reflected the change in consumption rather than price. During the same period, construction prices rose rapidly, at rates even higher than the general CPI.

Shortly after taking office, Drew Lewis, Reagan administration secretary of transportation, voiced these and other problems and suggested than an increase in the federal gas tax might be required to finish remaining segments of the interstate system, rehabilitate existing mileage and meet other highway needs. He was unable to secure presidential support for the tax increase. Rather, the administration was contemplating the shifting of responsibility for most transportation programs to the states. As part of its grand New Federalism scheme, the president wanted to turn over responsibility for all programs except interstate completion while simultaneously relinquishing the federal tax on gasoline. In its specific request for authorizing legislation for the highway program, the administration simply called for an elimination of federal aid for urban and rural highways.

Neither the House or Senate was willing to move on the administration blueprint.[9] The House wanted to increase the gasoline tax and expand the highway program. The Senate plan was less ambitious. A stalemate developed, and reauthorization was stymied.

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[7] George Peterson, "Federal Tax Policy and Urban Development". Testimony before the Subcommittee on the City of the House Committee on Banking, Finance and Urban Affairs, June 16, 1977, Washington D.C.: 1977.

[8] See Committee on Public Works and Transportation, U.S. House of Representatives, "The Status of the Nation's Highways: Conditions and Performance," Committee Print 97-2, Washington D.C.: 1981.

[9] For a description of recent administration and Congressional actions affecting highways, see Rochelle Stanfield, "The New Federalism is Reagan's Answer to Decaying Highway Transit Systems", National Journal pp. 1040-1044, June 12, 1980; Judy Sarasohn "Gas Tax Transportation Bill Wins Approval of the House, but is Stalled by Senate Foes" Congressional Quarterly, Dec. 11, 1982, pp. 2991-2995; Judy Sarasohn "Battle Weary Senate Clears Highway-Public Transit Bill Raising Fuel and Truck Taxes" Congressional Quarterly, Dec. 25, 1982, pp. 3088-3091.

After the elections of November 1982, and the attention devoted to unemployment problems, momentum developed for passage of legislation to create job opportunities. Since the president was opposed to what he labeled as "make-work" jobs legislation, expansion of existing highway repair programs became the object of this momentum. During the lame duck session (and after long filibusters in the Senate), Congress passed the Surface Transportation Act of 1982.[10]

The new law included several changes to existing programs. First and foremost, it made changes to several taxes feeding the highway trust fund. The excise tax on gasoline was raised from four cents to nine cents per gallon with all but one cent devoted to highway use. Highway use taxes levied on trucks were raised substantially. The justification for the rise was that heavy trucks were responsible for much of the deterioration of pavement conditions. The federal government tried to moderate the impact of these taxes on the trucking industry by limiting state authority to prohibit overly large trucks on their highways.

Funding for the highway aid program will rise due to the increase in trust fund revenues. The Surface Transportation Act authorized $12.7 billion for the highway aid program in 1983 and $13.8 billion in 1984. Authorization for all of the major programs rose with one exception—the urban road system. The biggest increases are for repair and rehabilitation of interstate highways and deficient bridges.

Two changes were made which have the effect of altering distribution patterns. First, the formula for distributing primary road system funds was changed. The House bill included a new formula based on urban and rural population which would have favored the more populous states, relative to the current formula. The final bill allowed states to base their share on either the old or new formula with pro rata reductions to accommodate total claims with existing funding levels. The second change required that each state's apportionment of highway funds equal at least 85 percent of the amount paid by its motorists in highway taxes. Other formula changes were considered but rejected for the time being. The secretary of transportation is required under the new law to study whether a variety of factors including traffic "volume and mix, weight and size of vehicles, environmental, geographical and meteorological conditions" ought to be taken into account in allocating highway funds.

While the Surface Transportation Act increased the authorization for the highway aid program, the more important figure for gauging levels of activity is the obligation ceiling imposed via the appropriation's process. The obligation ceiling was $8.0 billion in 1982. It jumped to $12,375 billion in 1983—$12.1 billion provided in the regular appropriations bill and $275 million provided in the jobs bill last spring. For 1984, the president proposed an obligations ceiling of $12.6 billion. Congress was somewhat more restrictive, allowing $12,520 billion.

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[10] Conference report on the budget, Congressional Record, Dec. 21, 1982, H 10780-H 10838.

Federal Support for Mass Transit

Federal support for mass transit first emerged in the early 1960s in the context of urban redevelopment efforts. In 1964, federal involvement was formalized with passage of the Urban Mass Transportation Act. Grants and loans were authorized for the acquisition, construction or improvement of facilities and equipment used in mass transit. Starting in 1966, the federal government also provided funding for planning, engineering and design activities. The oil embargo in 1973 and subsequent rapid rise in energy prices resulted in increased interest in mass transit. Congress allowed states to substitute mass transit projects for certain highway projects or interstate segments. It also greatly increased funding authorizations and established a new Section 5 program which could be used to subsidized operating as well as capital budgets of mass transit systems.[11]

Renewal of mass transit legislation was on the congressional agenda most of 1982 as the authorization for the program was scheduled to lapse September 30, 1982. The fiscal year ended, however, with Congress stalemated over alternative options. The administration wanted a smaller program overall, total elimination of operating subsidies by 1985, a focus for capital grants on rehabilitation of existing systems and incentives for transit systems to become self-supporting through the fare box. While opposition developed on several issues, the biggest concern on the part of cities and transit operators was the potential loss of operating subsidies.[12]

In addition, passage of reauthorizing legislation was complicated by the fact that a new distribution formula had to be considered. For years, the equity of the Section 5 formula, which takes into account population and population density, had been questioned. Older cities with heavy transit ridership argued that a population-based formula failed to recognize important differences in the role played by various transit systems in meeting overall local transportation needs. Some of these older cities maintain relatively large systems and serve many more people relative to their populations than do other systems elsewhere in the country. But given a population based formula, these older, transit oriented cities received a smaller grant per rider covering a smaller percentage of overall operating costs. The distribution controversy had been partially resolved in 1978 by adding an extra pot of money, distributed using the same population-based formula but with eligibility limited to the very large cities.

The distribution controversy was re-kindled, however, when 1980 census figures became available for use in the formula. The older cities, which had lost population over the decade, stood to lose substantial sums. While Congress, had worked out a shortrun solution in its fiscal year 1982 appropriations bill, specifying that half of the available funds would continue to be distributed based on the old population figures, the need for a long run solution was evident.

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[11] Chronology of mass transit legislation based on CONSAD Research Corporation, op. cit., G 146–G 155.

[12] "Overhaul of Government Aid for Mass Transit Awaits Congress' Attention" Congressional Quarterly, Nov. 13, 1982.

This complicated the process of building the coalition necessary to secure passage of legislation reauthorizing the UMTA program.

During the lame duck session, Congress finally enacted the Surface Transportation Act of 1982, reauthorizing mass transit programs as well as highway programs. Title III entitled "The Federal Public Transportation Act of 1982", changed the transit program in several respects:

1. *Dedicated funding.* One penny of the additional five cent tax on gasoline is to be dedicated on a trust fund basis to mass transit. In 1983, the trust fund will be used to supplement the appropriation for the Section 5 formula grant program (in Section 9A) but in future years the trust fund will finance the discretionary capital grant program.

2. *The discretionary capital grant program.* Except for the change in financing, the discretionary capital grant program is essentially the same as the old Section 3 program. The only major difference is that the federal share of project costs has been reduced from 80 percent to 75 percent. The discretionary capital grant program is intended for a higher level of capital project, not those that can be routinely foreseen. Under the Section 3 program, all capital projects were eligible, ranging from routine bus replacements to new rail system construction. The new law envisions more routine capital expenditures to be financed from the block grant program (to be discussed next), leaving a somewhat smaller discretionary grant program focused on major overhauls, expansions, new starts, etc. The administration's position of limiting funds to improvements of existing systems was not accepted by Congress. The conferees made it clear that it is their intent that a "fair share" of the mass transit trust fund be allocated to rapidly growing cities to further cost-effective new rail construction, bus fleet expansion and other related needs. Given available funding, however, it is not likely that many new starts can be accommodated. There appears to be no change in the section 16(b) program under which capital grants are made to nonprofit providers of service to the elderly and handicapped.

3. *Establishment of a block grant.* Most UMTA funding, apart from the trust-fund financed capital grant, will now be distributed under a new block grant program established in Section 9. This block grant will carry many more requirements than has been true of other recently enacted block grant programs in different functional areas. Even so it should make it easier for recipients to apply for and receive federal funds. A single application listing all proposed uses will be accepted in lieu of applications for each planned project. Also, there is provision for "self-certification" with respect to many of the requirements.

4. *Change in distribution.* The Section 9A grant in 1983 and its replacement Section 9 grant in 1984-1986 will be distributed on a somewhat different basis than the old section 5 formula grants. The distribution under the old program was based primarily on two factors—population and population weighted by density—with some tiering to assure more funding for larger transit-dependent cities. The population-based formula is retained for urbanized areas smaller than 200,000 in population, but for larger ones, some account is taken of service-related measures such as fixed guideway

or bus revenue vehicle miles. Starting in fiscal 1984, a small pot of money will be distributed based on the cost-efficiency of service provision. While a formula is used to determine the allocation of funds to all urbanized areas larger than 50,000, the governor is the recipient of funds allocated to areas with population smaller than 200,000.

5. *Use of funds.* In 1983, Section 9A funds, which supplement the existing Section 5 formula funds, may only be used for capital planning. Section 9, the program which replaces both Section 9A and Section 5 in 1984, may be used for capital planning or operating assistance. The new legislation imposed a restriction, however, on the amount of federal funds which may be used for operations.[13] The limit is based on historical levels of operating assistance received (i.e. Section 5, tiers 1, 2 and 3 funds received in 1982). The limit is set at 80 percent of the 1982 amount for urbanized areas larger than one million, 90 percent for those with populations between 200,000 and one million, and 95 percent for smaller urbanized areas. There appears to be no restriction in 1983 for urbanized areas newly qualifying for formula funds based on 1980 census data; as of 1984, they may not use more than 40 percent of their total block grant for operating purposes. An operator may elect to exceed these limits on the use of funds for operations, but if he does so, he forfeits some of his total block grant allocation. Forfeited funds are returned to the secretary for distribution at his discretion. No restrictions were placed on the use of funds received under Section 18 by non-urbanized areas.

6. *Authorized funding levels.* The new law authorized the following level of program activity through 1984:

TABLE 5.5.—AUTHORIZED FUNDING FOR MASS TRANSIT

[In millions of dollars]

	Formula block grant (sections 9 and 18)	Discretionary capital grant (sections 3, 4, 8 and 16b)
1983	[1] $779	
1984	2,750	[1] $1,250
1985	2,950	[1] 1,100
1986	3,050	[1] 1,100

[1] Contract authority based on Mass Transit Trust Fund.

The authorization level for the discretionary capital grant program is somewhat lower than the historic funding level for Section 3. The block grant authority, however, is higher than recent past budgets for the Section 5 and 18 programs.

The administration has proposed budget levels for fiscal years 1983 and 1984 which are significantly below those recently authorized by Congress. Since the authorizing legislation makes the mass transportation trust fund monies available for obligation (via contract authority), the administration has sought to achieve savings by proposing a limit on obligations. A limit was proposed both for fiscal year 1983, affecting the Section 9A block grant program, and for fiscal year 1984, affecting the discretionary capital grant program. Congress refused to limit obligations in 1983. For fiscal year 1984, it allowed obligations of $1,225 million, $125 million more than proposed in the administration's budget.

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[13] It affects section 5 funds in 1983 and section 9 funds thereafter.

TABLE 5.6.—COMPARISON OF AUTHORIZED FUNDING LEVELS, ADMINISTRATION PROPOSED BUDGET, AND CONGRESSIONAL ACTION: MASS TRANSIT TRUST FUND

[In millions of dollars]

	Contract authority provided in legislation	Obligation limit proposed in budget	Enacted by Congress
Fiscal year 1983 (block grant)	$779	$550	$779
Fiscal year 1984 (discretionary capital grant)	1,250	1,100	1,225

The formula block grant program (Section 9) and the rest of UMTA's activities require annual appropriations. The administration asked for $1,974 million in budget authority for 1984, $776 million less than the amount recently authorized for the programs with the cut concentrated in operating assistance. Even so, the president's request is higher than the levels provided in recent years. Congress made a more modest cut, appropriating $2,760 million for the UMTA program. Obligations for the programs replaced by the block grant totalled $1,433 in 1982. The appropriation for 1983 was $1,268.5 (plus the $779 million in contract authority mentioned above).

Regulatory changes. Other program changes, consistent with the president's New Federalism philosophy, have been adopted through administrative action. The Department of Transportation withdrew regulations implementing Section 504 of The Rehabilitation Services Act requiring transit operators to make all of their services fully accessible to the handicapped. It substituted a rule that simply requires transit operators to assure that they are making efforts to provide services to those with handicaps. It is anticipated that, with the added flexibility, transit operators can provide service using alternative, less costly methods.[14]

The administration has also proposed dropping "white book" rules which set forth detailed specifications for all equipment purchased with federal funds. This action is expected to reduce costs at least in the short run. It is possible, however, that there will be long-run costs resulting from reductions in equipment performance.

Federal Support for Airport Development

The federal government helps finance the development of and improvements to public use airports through the Airport Development Assistance Program (ADAP). While the current program has been in place since 1970, some version of airport aid has existed since 1946. Airport grants are provided on a matching basis and may be used for such things as land acquisition, construction or major repair of runways, taxi ramps, aprons, lighting, navigator aids, etc. They may also be used to purchase equipment for safety, security or snow removal purposes or on noise abatement projects.[15] The federal government also supports air transportation through the operation of the air traffic control system.

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[14] Presidential Task Force in Regulatory Relief "Reagan Administration Achievements on Regulatory Relief for State and Local Government," August 1982, p. 8.

Airport development assistance has been financed through a trust fund supported by specific taxes on aviation and jet fuel and on passengers and shipments carried by scheduled airlines. Facilities and equipment required by the Federal Aviation Administration (FAA) for the airway system also have been funded out of the trust fund. Most of FAA's operating costs, however, have been financed with general tax revenues.

The federal government prepares a national airport system plan on a regular basis. In its 1980 plan, FAA estimated airport developments costing $12.6 billion would be required through 1989. Approximately $2 billion is needed to maintain the physical integrity of existing systems; $2.23 billion is required to bring existing airports up to design standards. The remaining $8.3 billion is needed to accommodate anticipated demand. FAA estimated air carrier emplanements would rise 61 percent over the period while commuter emplanements would rise a whopping 170 percent. In addition, the FAA has called for a substantial investment in modernization of the air traffic control system.

The airport development program was scheduled for reauthorization in 1980. Congress failed to act, however, as it was unable to reach agreement on how and if the program should be restructured. With the lapsing of the legislation, the various aviation tax rates dropped to lower levels and receipts were directed to either the general fund or the highway trust fund.

The administration sought fairly major changes in the program. It wanted to eliminate support for the 41 largest airports, forcing them to raise funds for capital improvements on their own. It would have created a much smaller state-administered block grant to support airports serving smaller communities and general aviation. The administration priority was to improve the air traffic control system rather than develop airports. It also argued that the operating cost of the airway system should come from the trust fund and be paid for by air users rather than the general taxpayer. It wanted to raise general aviation fuel taxes to levels higher than had been imposed in the past and to restore the ticket tax to prior rates.[16]

When Congress finally acted in late 1981, it chose to defer action on the administration's de-federalization block grant proposal, instead reauthorizing the airport program in a form much more closely resembling the original program.[17] It did, however, direct the secretary of transportation to study the question of larger airports becoming self-financing. The most important change embodied in the legislation has only an indirect effect on the airport grant program. Congress accepted the principle put forward by the administration that the cost of operating and maintaining the airway system ought to be financed by users through the trust fund. While user taxes were raised to accommodate this new claim on the trust fund, it is significant that capital improvements lost their exclusive claim on the trust fund.

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[15] Brief history of airport assistance can be found in CONSAD Research Corp., op. cit., pp. G 110–G 120.

[16] For an account of the controversy in Congress see "Tough Questioning Awaits FAA Multibillion Dollar Plan to Update Air Traffic Control." Congressional Quarterly Mar. 6, 1982; "Legislation Underway to Revive Airport Aid," Congressional Quarterly, May 15, 1982; "Tax Bill Passed", Congressional quarterly, Aug. 21, 1982.

[17] The Airport and Airway Improvement Act passed as Title V of tax act (TEFRA) of 1982. A copy appeared in the Congressional Record, Aug. 17, 1982, pp. H 6266–6276. See also J.J. Corbett, "Reflections on the New Airport/Airway Trust Fund Law", Airport Services Management, September 1982, pp. 26–29.

The new legislation made only small changes to the ADAP program, but several are worth noting.

1. *Greater reliance on discretionary grants.* Under the 1981 law, fewer airports are eligible for funding on an entitlement basis. Under the old law, all airports with scheduled air services received funds on a formula basis. These air carrier airports could count on receiving funds every year, and they had a lot of discretion regarding the use of these funds. In addition, they could supplement their formula grants by competing for grants awarded by FAA on a discretionary basis. The new law establishes a new category of "primary airports"—currently defined as those emplaning more than 31,000 persons per year—and limits formula funding to these airports. The smaller air carrier airports will be eligible only for discretionary grants, with 5.5 percent of ADAP funds nationwide set aside for their use. The major impact of the change in law is that it will make it more difficult for these smaller airports to plan capital improvements as they can no longer count on federal funds being available in any given year. A greater reliance on discretionary grants runs counter to a New Federalism philosophy.

2. *New eligibility for private airports.* Under the old ADAP legislation, only publicly-owned airports were eligible for federal assistance. Now eligibility has been extended to privately-owned reliever airports so long as they assure that new facilities will be available for public use over a 10-year period.

3. *More funds for general aviation.* The new legislation is expected to increase the share of ADAP funds going to categories of airports that can't easily generate their own revenues—the smaller airports with little or no scheduled air carrier services. Since passengers of scheduled airlines are responsible for most of the income to the trust fund (over 80 percent), there is considerable subsidization of general aviation by the broader flying public.

4. *Funding levels.* The administration had suggested that Congress set a flat annual authorization level for $450 million for the ADAP program. This is the same amount as was appropriated in fiscal year 1981 but it is significantly less than the annual funding level provided during the latter half of the seventies. For example, in 1980, $645 million was appropriated for ADAP. Congress held the line for fiscal year 1982, authorizing appropriations of $450 million, but it increased future authorization levels to $600 million in 1983, rising to $1.017 billion in 1987. Later in the same session (in the Surface Transportation Act), Congress amended the ADAP program and increased its authorization in 1983, 1984 and 1985. The additional funds are to be distributed on a discretionary basis by the Secretary of Transportation.

The 1984 budget: The administration's 1984 budget calls for a program at lower levels than provided for in the authorizing legislation. Since the legislation provides contract authority (allowing the secretary to obligate funds), the only way to achieve budget savings is to enact an obligation limit. An obligation limit was included in the 1983 appropriations bill, hence obligations in that year are estimated at $654 million rather than $800 million as called for in the authorizing legislation. For 1984, the president proposed an obligation limit of $700 million, $294 less than authorized, but a modest increase over last year's level. Congress opted for an obligation ceiling of $800 million.

TABLE 5.7.—FUNDING AUTHORIZED FOR AIRPORT DEVELOPMENT ASSISTANCE

[In millions of dollars]

	1980	1981	1982	1983	1984	1985	1986	1987
Airport and Airway Improvement Act of 1982			$450	$600	$794	$912	$1,017	$1,017
Surface Transportation Act of 1982				200	200	75	0	0
Obligation ceiling			415	654	800			
Total	$645	$450	450	800	994	987	1,017	1,017

Federal Role in Water Resource Development

The federal government plays an important role in financing and constructing a wide range of water resource projects. Some projects are designed to facilitate water transportation (e.g. navigational canals, locks and dams, port and harbors). Other projects involve the construction of dams and reservoirs. These projects serve several purposes including flood control, drainage, irrigation, municipal and industrial water supply, recreation, fish and wildlife conservation and recreation.

Federal involvement is justified on several grounds. Some projects are designed to enhance the economic development of an area or region. Others provide non-salable benefits that the private market would not readily furnish. Many projects are so large in scale and affect so many states, that it would be difficult for state and local government to respond to identified needs. Federal water projects are generally multipurpose, and water supply for agricultural, municipal or industrial use represents just a part of the total benefits to be derived from a project. For the most part, projects are financed by the federal government and constructed under the auspices of federal agencies. Responsibility for operations and maintenance sometimes remains with the federal agency and at other times is passed to a local jurisdiction.

Federal water resource policy is administered by a number of agencies, most important of which are the Army Corps of Engineers, Bureau of Reclamation, Soil Conservation Service and Tennessee Valley Authority (TVA). Their operations are governed by numerous pieces of federal legislation.[18] Two of the four agencies are restricted in scope to specific geographic areas and were set up to foster economic development. The Bureau of Reclamation was charged with aiding western state development and the TVA works in the southern states comprising the Tennessee River Basin. It is not surprising given the geographic focus of two of the four major agencies, that federal investments have been focused on the southern and western portions of the country. Between 1950 and 1975, 37.9 percent of all expenditures by the four agencies were in the South and 36.1 percent in the West. Twenty percent was spent in the north central region and 6 percent in the Northeast.[19]

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[18] For a listing of statutes, see Congressional Budget office, "Current Cost Sharing and Financing Policies for Federal and State Water Resources Development," (Washington, D.C.: Congressional Budget Office, July 1983, pp. 6-7.

Federal funding for construction, operation and maintenance of water resource projects has been declining. Appropriations averaged between $5.5 and $6.5 billion (in 1982 dollars) during the early sixties, peaking in 1965. Funding reached a low of $3.7 billion in 1983. Appropriations for water project construction have declined even more rapidly from a high of $6 billion to $1.3 billion in FY84. Spending for operation, maintenance and rehabilitation of existing facilities has increased, however, over the same period.[20] No new water resource projects have been authorized since 1976 and many authorized projects have not had funds appropriated.

Funding for water projects has declined for several reasons. First, many officials question the efficiency of the federal water program. The benefit-cost ratio of some projects was low when calculated several years ago. The analyses were based on interest rates far below those currently prevailing. Critics allege that these projects would fare poorly if benefits and costs were re-calculated under current conditions. Second, Congress and the president have failed to agree on the proper role of the federal government in financing water projects. At issue is the allocation of costs among the federal government, state and local governments, and water users. The issues of efficiency and cost sharing are closely related, for if the true costs of water development were borne by beneficiaries, it is unlikely that marginal projects would be constructed.

Present cost-sharing arrangements are complex and vary by project purpose and administering agency. For most projects, the federal government finances all capital costs up-front, but it receives partial reimbursement over time by users and through contributions by state and local governments. The federal government generally bears the full cost of what are considered to be "nonvendible" outputs such as flood control, recreation, and fish and wildlife conservation. There is partial cost recovery where there are vendible outputs such as water supply for municipal and industrial uses, hydropower etc.

The actual allocations of costs cannot be ascertained by reading statues but rather must be calculated by combining effective capital cost shares with the capitalized present value of annual operating, maintenance and rehabilitation expenditures contributed by each participant over a project's life. The Water Resources Council has calculated that the effective non-federal share of costs for municipal and industrial water supply on Army Corps projects is 54 percent and on Bureau of Reclamation projects is 71 percent. The non-federal share of the cost of water used for irrigation is 19 percent on corps projects and 18 percent on bureau projects.[21] Most recovery from farmers is so low because the law limits payments to that which is affordable and, farm economies usually do not allow them to pay the full cost of water supplied.

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[19] "Changing Directions in Water Management" Proceedings of the National Water Symposium, November 17-19, 1982 (Washington, D.C.: American Public Works Association, 1983) p. 18.

[20] See U.S. Congressional Budget Office, "Public Works Infrastructure: Policy Considerations for the 1980's" (April 1983) p. 74 and U.S. Congressional Budget Offices, "Efficient Investments in Water Resources: Issues and Options," August 1983 pp. 21-22.

President Carter sought a major change in water resource policy—systematizing cost-sharing arrangements across programs and reducing the federal share of total costs. Specifically, he advocated that states share costs at the time of construction, providing 10 percent of the cost of vendible outputs and five percent of other costs. Any revenues later collected from the sale of vendible outputs would be split between the federal and state governments in proportion to their investment. Since President Carter was viewed as hostile to federal water programs (based on his "hit-list"), his proposals for cost-sharing were not given a serious hearing.

The Reagan administration is viewed as favorable to western interests and to water programs, but it, too, appears committed to a change in water policy along the lines sought by President Carter. The Cabinet Council charged with reviewing cost-sharing policy recommended the following principles:

1. Due to federal budgetary constraints, non-federal cost sharing is necessary to provide needed development.
2. Non-federal "upfront" contributions are preferable and should be presumed in all cases, with limited exceptions.
3. Beneficiaries should pay the cost of services.
4. Above-cost pricing should be considered where the value of water is higher than its cost.
5. Agricultural water supply and flood control require more flexible cost sharing, though non-federal interests should pay a significant share of costs.

The Cabinet Council recommended cost sharing percentages ranging from 35 percent to 100 percent depending on purpose. For agriculture, the recommended non-federal share would be 35 percent or more depending on user benefits and for municipal and industrial water supply it would be 100 percent. The president has not formally acted upon these recommendations and has not submitted a proposal to Congress on this issue. It has sought, however, to achieve these cost allocations through administrative actions on projects included in the president's budget.

Even though the cost allocations being considered by this administration are harsher than those proposed by President Carter, state and local governments and affected interests have been willing to negotiate. Some greater cost-sharing on their parts is viewed as inevitable and they fear that until an agreement is reached, federal funding for water resource projects will continue to decline. Several states have taken steps to procure the funds needed to participate in jointly-financed projects.

Other Federal Involvement in Water Issues

Projects undertaken by the Army Corps of Engineers, SCS, BOR, and TVA provide water supply and storage for some domestic, industrial and agricultural users. These agencies do not, however, help with the distribution or treatment of water supplies.

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[21] U.S. Congressional Budget Office, "Efficent Investments in Water Resources: Issues and Options," August 1983 p. 15.

The federal government plays only a very small financial role in the distribution and treatment of water supplies. Some grant assistance is available from the Farmer's Home Administration in a program discussed in the Wastewater Treatment Section of this chapter. Eligibility for this program is limited to small towns and rural areas. Other communities may use Community Development Block Grant funds or, in some instances, Economic Development Administration grant funds to develop water supply, distribution or treatment capacities if used on water infrastructure, communities must forego financing of other eligible projects.

While not providing financial assistance, the federal government has assumed an important role as a standard setter with respect to the quality of drinking water. The Safe Drinking Water Act mandates that all public water supplies must be inspected and if certain impurities are found, be subjected to treatment procedures.

Federal Support for Wastewater Treatment Facilities and Sewer Construction

The federal government first became concerned with water quality and municipal sewage treatment early in the 1950s. As a result of the growth in the environmental movement, Congress passed major legislation in 1972 increasing the level and type of federal involvement in the issue area. It simultaneously established regulations—requiring secondary treatment for almost all municipal wastes by 1977—and greatly expanded financial assistance for the construction of the required facilities.

The waste water treatment construction grant program. The 1972 legislature authorized the federal government to spend $18 billion between 1973 and 1975, funding 75 percent of the cost of eligible projects. Federal money could be used for secondary and advanced treatment facilities, interceptor sewers, collection systems, sewer rehabilitation, correction of infiltration and inflow and combined sewer problems.[22]

The 1972 legislation was notable in establishing a minimum technology-based standard; all wastes required secondary treatment regardless of the impact of the discharge on local waterways. There was a clear link with water quality only in those instances when advanced treatment technologies were required to assure achievement of water quality standards.

As 1977 approached, it became apparent that municipalities were not going to meet the deadline for installation of secondary treatment facilities. The estimated cost of construction facilities had increased. The funding which had been committed was only slowly being translated into completed facilities. The Clear Water Act Amendments extended the deadlines and provided additional funding for the program.

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[22] See CONSAD Research Corp., op. cit., pp. G 181–G 189; Statement by John Hernandez, Deputy Administrator, Environmental Protection Administration, Hearings Before the Subcommittee on Environmental Pollution of Committee on Environment and Public Works, U.S. Senate, June 1981.

The program was up for reauthorization again in 1981 and the administration proposed that no funds be made available unless Congress agreed to changes in the program. The construction grant program had been subject to major criticism from GAO and the press. Critics alleged the program was cumbersome (typical time from start to finish was six to nine years), overly expensive, produced plants with inadequate performance records and yielded little improvements in water quality. Many of the criticisms were greatly overstated, but when combined with pressures to cut the budget, it became clear that changes would be made to the program.

Both Congress and the administration were concerned that despite appropriation of over $33 billion between 1973 and 1981, the estimated cost of all eligible projects had actually increased by $24 billion between 1976 and 1980. The increase was due primarily to price inflation.

The legislation which emerged in 1981 did little to reduce the requirements imposed on states and localities concerning sewage discharge, although it delayed the compliance deadline until July, 1987. What it did, however, was reduce the federal role in helping state and localities meet standards.[23] It did so in four ways.

1. *Redefinition of eligible projects.* Under the new program, funding is directed primarily towards treatment plants, interceptors and infiltration/inflow projects. The governors will be allowed to use up to 20 percent of a state's allotment for other types of projects eligible under the old law. The administration would have been even more restrictive—eliminating infiltration/inflow correction projects as an eligible category and providing no discretionary fund. The rationale for reducing categories of eligibility is that it will direct federal funds toward projects with the greatest impact on water quality.

2. *Reserve capacity.* Under the old law, communities could build facilities with sufficient capacity to serve population growth expected over a 20-year period and have the federal government pay 75 percent of the cost. Now the federal government will only help pay for capacity appropriate for population in place at the time the plant is constructed and in no case population greater than that in place as of 1990. The administration had proposed an even more stringent law, wanting federal funding to be limited to backlog projects only—that is, those required to serve populations existing in 1980 in communities not now meeting discharge requirements.

3. *Lower authorization levels.* The 1981 law authorized annual appropriation through 1985 of $2.4 billion. This is the same level requested by the administration. As shown in Table 5.8 however, prior year funding levels were considerably lower.

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[23] See Municipal Wastewater Treatment Construction Grant Amendments of 1981, Public Law 97-117, 95 Stat. 1623.

TABLE 5.8.—FUNDING FOR WASTEWATER TREATMENT, CONSTRUCTION GRANT PROGRAM

[In millions of dollars]

	Budget authority	Obligations	Outlays
1979	4,200	3,879	3,756
1980	3,400	4,673	4,343
1981	1,605	3,942	3,881
1982	2,400	2,117	3,756
1983	2,430	3,000	3,100
1984	2,400	2,400	2,800

4. *Reduced match.* Under the new law, the federal share would be reduced to 55 percent from 75 percent by 1985. The lower match will allow available funds to be spread among more communities and hopefully, will encourage local officials to purchase cheaper, more cost effective treatment systems.

The effect of the above changes was a reallocation of funds among states. Under the old law, each state's share of grant funds was equal to its share of the cost of completing all eligible projects nationwide. The basic principle for allocating funds was retained, but with the redefinition of eligible projects, states' shares changed. The new law reflects disagreement which existed between the House and Senate over which types of projects should be eligible and ties the allocation to specific percentages rather than to the needs' study per se. While all states lose money because of the reduction in funding level, some states lose more than others due to the reallocations.

While not a result of the 1981 legislation, there has been another significant change in the construction grant program. In an effort to implement the president's New Federalism philosophy, EPA has pursued a policy of full state delegation. The 1977 amendments to the program has provided states with the option of assuming most project review responsibilities. The administration is trying to get all states to assume that responsibility. Some, however, have expressed reluctance based on inadequate funding levels for administrative costs.

Water quality regulation. Thus far, the discussion has focused on changes to the construction grant program. It is equally important to look at the legislation and regulations governing water quality standards. It is these standards that may result in a discharge permit necessitating more costly advanced (rather than secondary) treatment technologies.

Under the guidelines established by the EPA, states have responsibiity for determing what uses occur or are reasonably able to occur in its streams and to adopt water quality standards to protect those uses. The intitial determination of use is most crucial since the limits for pollutants follow from that classification. EPA has a guideline (the red book) containing estimates of maximum allowable concentrations of pollutants consistent with specific uses (e.g., chlorine limits of 2.0 µg 1 for salmonid fish). The aquatic life classification generally requires the highest water quality standards for most pollutants.

The administration has proposed several types of changes to the procedure for establishing water quality standards. It argues that many states have overclassified streams, forcing use of advanced treatment technology when not necessary. It wants all classifications to be more site-specific and attentive to local conditions (e.g., in a specific stream segment, flow or bed characteristics may not support aquatic life despite removal of economic as well as environmental criteria). If it is too costly to improve a stream's water quality, its use classification could be downgraded and standards eased. Third, it has dropped the "presumptive applicability" requiring making it easier for states to impose less stringent pollutant limits for a given stream use than those specified in the "red book" guidelines. None of these regulatory changes have been finalized. Indeed, the new administrator, William Ruckleshaus, is reconsidering the administration position.

Federal Support for Rural Water and Waste Disposal Systems

The Farmers Home Administration (FmHA) traditionally has been a source of financial assistance for water and waste disposal facilities built in rural areas and small towns. Nonprofit organizations and local government agencies, unable to secure needed funds from other sources at reasonable rates or terms, could apply to the Farmers Home Administration for a low-interest loan and, in some instances, for a grant as well. Funds are allocated among states by a formula but actual distribution depends on proposals submitted to the Farmers Home Administration.

Prior to 1980, all Farmers Home Administration loans were made at a 5 percent interest rate. Since the typical municipal bond rate has been higher than 5 percent, the loan program provided a direct subsidy to participants. Grants were available if the user charges which would be required to pay off the debt exceeded a specified a percentage of median family income in the community. This is the only federal capital program that takes explicit account of community fiscal ability in determining the amount of federal assistance to be provided.

Significant changes in the program were adopted as part of the Reconciliation Act of 1981. Instead of loaning money at 5 percent, the Farmers Home Administration was directed to lend at the same rate faced by municipalities issuing new bonds. The primary role of the agency was thereby redefined. It was to supplement the operation of financial markets in rural communities rather than subsidize investments in water and waste systems. The Farmers Home Administration could continue to make loans at reduced rates of interest under some circumstances. Very low income communities needing the funds to correct a health hazard could qualify for an interest rate of 5 percent. To meet the income criterion, median family income has to be below the poverty level. To qualify on the second count, the community must be the subject of a citation by a state or local regulatory agency. The Farmers Home Administration may also issue below-market rate loans to an additional set of communities. Those with median family incomes less than 85 percent of the non-metropolitan average may apply for a loan with a rate set midway between 5 percent and the current municipal bond market rate.

At the same time that these changes in program structure were made, funding for the program was cut almost in half. In fiscal year 1982, Congress appropriated $375 million for the loan program and $125 million for grants, down from $750 and $200 million respectively in 1981. Funding for 1983 was initially held at 1982 levels. But in actions taken this spring and summer to spur the economy and reduce unemployment, Congress increased fiscal year 1983 funding levels $225 million in loan authority and $175 million in the grant program.

TABLE 5.9.—FUNDING FOR THE FmHA WATER AND WASTE DISPOSAL LOAN AND GRANT PROGRAM

[In thousands of dollars]

Fiscal year	Program element	Appropriated level
1984	Loans	$270,000
	Grants	90,000
1983 (estimated)	Loans	600,000
	Grants	300,000
1982	Loans	375,000
	Grants	125,000
1981	Loans	750,000
	Grants	200,000
1980	Loans	700,000
	Grants	282,500

The President's budget for 1984 called for a further reduction in federal funding for the water and waste disposal loan and grant programs. Loan authority nationwide would be reduced to $250 million and the grant program to $90 million. Congress appropriated $270 million for the loan program but accepted the president's recommendation for the grant component.

Anti-Recession, Job Creation Legislation

Despite a deep and prolonged recession, the administration resisted enactment of pump-priming activities of the sort relied upon in previous downturns. To encourage recovery from the big recession in the mid-seventies, President Carter had proposed an economic stimulus program consisting of a countercyclical revenue-sharing program, public service employment and local public works (LPW). The latter program distributed funds to local governments and was responsible for construction of a wide variety of public facilities. Approximately half was spent on basic infrastructure investments. LPW, like antirecession public works efforts before it, was criticized as being relatively ineffective as a counter cyclical device.[24] According to its critics, it took too long to bring construction projects on line so that too much of the spending occured too late in the cycle to be effective. Also, many of the jobs created required a high level of skill and did not reach the unemployed in greatest need of assistance.

As mentioned previously, the election in November of 1982 changed the political climate sufficiently to renew interest in anti-recession legislation. Even though most economists thought the economy was already on the upswing, the Surface Transportation Act of 1982 passed in large part because it was believed that an increase in funding, especially for rehabilitation and repair components of the program, could produce new jobs. In addition, a jobs bill was passed in the Spring of 1983. Congress again chose to make use of existing program structures, creating employment through added funding for maintenance and repair activities. Appropriations provided through this bill are mentioned in the relevant program sections.

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[24] Office Management and Budget, "Public Works as Countercyclical Assistance," Washington D.C.: November 1979.

Policy Changes Affecting the Municipal Bond Market

State and local borrowing costs (hence the cost of infrastructure development) have been very high over the last couple of years as a result both of the interest rates generally prevailing in the economy and the relatively poor performance of the municipal bond market.

All types of borrowers have been hurt by the high interest rates which prevailed during 1981 and 1982. Long run expectations regarding inflation combined with tight money policy to produce prime rates near 20 percent and long-term tax-exempt bond yields higher than 13 percent. Interest rates have now come down somewhat as a result of the deep and prolonged recession and the lessening of inflation rates. but there is great concern that the combination of economic recovery and high federal deficits will cause interest rates to climb once again. Due to the tax cuts enacted in 1981 and increases to the defense budget, federal deficits are projected to reach unprecedented levels (7.1 percent of GNP in 1984 under a current services forecast) and remain high through 1988. At the same time that the federal government will be making heavy demands on money markets, private borrowing should also be up as investment increases in response to more favorable economic conditions. With all that demand for money, interest rates could rise, hurting state and local borrowing and possibly choking off the economic recovery.

State and local government borrowing problems are also attributable to the poor performance of the bond market. Significantly, the gap between average yields for taxable and tax exempt bond issues has narrowed (see Table 5.10). One study estimated that this reduction in spread increases cities' borrowing costs by $130,000 for each one million dollars in bond issued.[25]

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[25] Francis Viscount, "City Fiscal Conditions in FY 1983," National League of Cities: Washington D.C., December 1982.

TABLE 5.10.—SPREAD BETWEEN TAXABLE CORPORATE BONDS AND MUNICIPAL BONDS, 1970–1982

	New long-term tax-exempt debt issued (millions)	Corporate bonds, AAA	High grade municipal bonds	Ratio
1970	$17,762	8.04	6.51	0.81
1971	24,370	7.39	5.70	0.77
1972	22.941	7.21	5.27	0.73
1973	22,953	7.44	5.18	0.70
1974	22,824	8.57	6.09	0.71
1975	29,326	8.83	6.89	0.78
1976	33,845	8.43	6.49	0.77
1977	45,060	8.02	5.56	0.69
1978	46,215	8.73	5.90	0.68
1979	42,261	9.63	6.39	0.66
1980	47,133	11.94	8.51	0.71
1981	46,134	14.17	11.23	0.79
1982	74,877	13.79	11.57	0.84

Source: Economic Report of the President, February, 1982, Table B-91, Moody's Municipal and Government Manual, 1983, p. 26.

While the ratio of tax-exempt to taxable bond interest rates has shown some fluctuation in the past, there is a concern that the narrowing at this time is due in part to structural changes in the market. The Economic Recovery Tax Act of 1981 (ERTA) changed the law in several ways that reduce the attractiveness of investing in tax-exempt bonds. First, it reduced the top marginal tax rate from 75 percent to 50 percent and put in place a schedule for across the board rate reductions, thereby lowering the benefit of holding tax-exempt securities. It also reduced the tax rate on capital gains, making other investment relatively more attractive than in past years. ERTA also offered opportunities for the leasing of tax advantages—an option taken by some of the institutional investors. Use of this tax shelter was later restricted but it may have contributed to the lower level of municipal bond purchases by commercial banks and insurance companies in 1981. The Economic Recovery Tax Act also increased other opportunities for tax-sheltered investments, again reducing the market for municipal bonds. It created the All-Savers certificate and broadened eligibility for tax-deferred individual retirement accounts.

Another explanation for the relatively poor performance of the bond market lies in the increasing issue of private-purpose tax exempt bonds. Table 5.10 shows that these securities accounted for 49 percent of the value of all long term bond offerings in 1982, up from a 21 percent share in 1975.

TABLE 5.11.—PRIVATE PURPOSE TAX-EXEMPT SECURITIES ISSUED, 1975–1982, SELECTED YEARS

[In billions of current dollars]

	1975	1980	1981	1982
Housing (includes mortgage revenue bonds)	1.5	14.0	5.6	14.4
Private hospital	1.5	2.7	3.9	7.3
Student loans	0.0	0.5	1.1	1.8
Pollution control	2.5	2.9	4.7	6.6
Small-issue IDB's	1.3	9.2	12.6	12.7
Total private purpose	6.8	29.3	27.9	42.8
Total long-term tax-exempt issues	32.4	55.2	57.9	87.6

Source: National Journal, June 25, 1983, p. 1354.

Private purpose tax-exempt bonds compete with more traditional state and local government offerings. In order to lure more investors into the tax-exempt market to absorb all of the available issues, yields must rise to make the tax-exempt bond as desirable as taxable investment alternatives for individuals with somewhat lower marginal tax rates.

The administration proposed that issues of industrial revenue bonds be limited. Congress wrote a series of restrictions into the Tax Equity and Fiscal Responsibility Act of 1982 that should lower the number of industrial revenue bonds issued. For example, businesses taking advantage of industrial revenue bonds are denied use of accelerated depreciation through the Accelerated Cost Recovery System (ACRS) for the portion of their investment receiving tax-exempt financing. Other restrictions are procedural, requiring public notice and hearings, and specific approval of elected officials before an industrial revenue bond can be issued. Even with these restrictions, private purpose securities are expected to claim approximately 50 percent of the tax-exempt bond market in 1983.

The effective functioning of the bond market is clearly crucial to the ability of state and local governments to solve infrastructure problems. If the past is any guide to the future, then one would expect approximately half of all capital expenditures to be financed by tax-exempt bond offerings. Yet give the problems identified above (many exacerbatd by recent changes in federal policy), many experts doubt whether the market as presently structured can absorb the magnitude of debt control required to meet state and local investment needs. As bond offerings increase, the spread between taxable and tax-exempt yields may be further reduced; federal tax expenditures would increase, and greater percentage of the federal subsidy would benefit investors rather than state and local government borrowers. These projected difficulties have increased interest in the development of new financing mechanisms.

CONCLUSION

The administration's New Federalism is designed to reduce the role of the federal government in virtually all areas except defense. The president would like to see a shift in responsibility from the federal government to state and local governments or the private sector. Other New Federalism themes include deregulations and reduction of redistribution through the public sector. To achieve the latter, the administration would like to shift the burden of financing government services onto the direct beneficiaries.

To what extent are the legislative, administrative and budgetary changes consistent with these New Federalism themes? The answer is mixed in large part because the administration failed to translate its policy prescriptions into law.

The administration voiced support for significant reductions in the federal role in infrastructure development. Its grand "New Federalism" scheme, unveiled in the State of the Union message in January 1982, would have included all of the grant programs discussed in this paper, with the exception of the interstate component of the highway program, in the "turnback" package. While the administration proposed some grant support in the short run and to vacate some tax sources in the long run, the proposal essentially envisioned states raising money from their own sources to support all infrastructure development. The New Federalism grand scheme, however, was never translated into specific legislation for submittal to Congress.

In its actual submissions of proposals to Congress, the administration still called for a reduced federal role, but not a wholesale abdication of responsibility. The administration wanted to de-federalize large airports, to give responsibility for secondary roads to the states, to remove federal support for mass transit operations and to limit the categories of wastewater treatment system investment eligible for federal support. Only a few of the administration's proposals were embodied in legislation receiving the approval of the Congress.

Some reductions in the federal role were achieved, at least initially, not by structural shifts but rather through the budgetary process. The Economic Recovery Tax Act reduced taxes and placed sufficient pressure on the non-defense budget so that few expenditure programs escaped the budget scalpel during the 1982 budget cycle. The infrastructure programs were no exception. Obligation levels in 1982 in every one of the major infrastructure programs were reduced from prior year levels. For the most part, however, further reductions were not imposed thereafter. Indeed Congress authorized significant increases in funding for the various transportation programs in fiscal years 1983 and beyond. While the administration would prefer spending less than the amount authorized, its budget proposal for fiscal year 1984 allowed for some increases.

With respect to deregulation, the results are mixed. The biggest change occurred in the transit program with the shift to a block grant format and the relaxation of Section 504 and white book regulations.

Chapter 6. POLICY RECOMMENDATIONS

On July 15, 1982, in Rocky Mountain National Park, above the town of Estes Park, Colorado, an 80-year-old dam owned by an irrigation company failed. The flood waters killed three people and resulted in $30 million in property damage. Just this past summer, a water main in New York City collapsed virtually shutting down the City's busy garment district for several days. These are only two of the more dramatic, recent effects of public works disinvestment which symbolize the magnitude of the infrastructure problem facing the United States.

Previous chapters have portrayed the substantial difference between needs—the estimated costs of bringing the nation's infrastructure up to some desirable level of service—and the financial resources that will likely be available. The funding gap reflects the substantial disinvestment which has been occurring throughout the United States as well as the nation's inability to keep up with its own growth. This chapter will explore ways to pay the bill and/or fill the gap between revenues and priority needs.

The advisory committee's national policy recommendations follow from the four major conclusions of this study:

> The problem is national in scope. It is not limited to any region or to any state;
>
> The problem is manageable, if public sector capacity to define needs and budget scarce resources is increased significantly;
>
> The problem requires that state and local governments assume basic management and funding responsibilities; and
>
> The problem requires a predictable and long-term response by the federal government.

A NATIONAL PROBLEM

All regions of the country have sizable gaps between infrastructure needs and resources to attack the problem. Yet, there are differences between regions. Infrastructure needs in the older industrial regions of the Northeast and Midwest stem primarily from deterioration and obsolescence of a capital plant put in place many decades ago. The principal issue in these regions is one of revitalization. Conversely, the infrastructure gap in the West stems from the demands engendered by population growth. While infrastructure problems may vary across the nation, per capita cost estimates appear reasonably uniform—and always considerable.

Gross national or regional characterizations should not blur the considerable variations within each region and, indeed, within most states. Most regions are comprised of states whose infrastructure priorities relate primarily to development pressures as well as states whose priorities generate from deteriorating facilities.

Within some states—often within a few miles of each other—are growing areas without sufficient water or adequate sewer lines and other areas with outmoded or deteriorated public works. To describe regions or states only in statistical averages generally does not reflect their internal diversity.

Although the size of the gap between the cost of estimated infrastructure needs and available revenues through the year 2000 is very significant, it seems likely that it is manageable. Clearly, economically healthy states and states with adequate fiscal strength will be better able to respond to priorities. But even for these "healthy" states, a unique and sustained partnership, heretofore absent in this country, between all levels of government and the private sector, will be essential.

This study uncovered a great deal about the inadequacy of infrastructure planning and budgeting. While state and local governments are hard at work building their capacity to plan for and manage infrastructure investment, at this time, only a relatively few states and communities have developed formalized, coordinated planning and budgeting procedures. Indeed, responsibility for infrastructure management, assessment and evaluation is fragmented in most areas of the country.

Availability of solid data is uneven. Needs projections in some states are quite speculative. Many states were only able to provide "wish lists" generated by their diverse agencies. In addition, some filtered their estimate of needs through a set of fiscal and political constraints. Rarely were states able to articulate values or, in some key infrastructure categories, define the standards of measurement, that generated analyses of current or projections of future needs. Only a handful of states attempted or considered risk and benefit-cost analysis concerning possible infrastructure investment strategies.

Problems in estimating available revenues were also observed. Many states are having visible trouble "making ends meet". Many face uncertain economies. Some have had constitutional and administrative lids placed on their revenue-raising abilities. There is considerable uncertainty about the future federal role with respect to infrastructure development (see Chapter 5). Finally, there is anxiety about the condition of the tax-exempt bond market and its accessibility to state and local governments.

The Federal Role

The federal government has played a major role in helping, indeed stimulating, state and local government infrastructure investment. Federal capital investment grants ranged from about 23 percent of state/local investments to 43 percent during the 1970s. Even in 1981, federal grants-in-aid for capital investment hovered at around 40 percent of total state and local investment.

Debate over the President's "new federalism" has generated concern over significant budget cuts in programs aimed at funding infrastructure. As noted earlier, while budget levels for highways, bridges and transit remain relatively high, there have been cutbacks in programs to assist water and sewer systems as well as airports. Just as relevant, formula changes have required fiscally troubled state and local governments to increase their matching contributions. In addition, reductions in gasoline consumption threaten the stability of fuel-tax revenues for surface transportation.

Clearly, the federal role in infrastructure development is changing. Just as clearly, there likely will be no comprehensive redefinition of, or massive change in, the federal role in the near future. It appears that the federal government will continue to provide measured kinds of financial support and to set standards concerning infrastructure development. Precipitous reductions in or amendments to either function will be tempered by commitments already made, as well as by institutional, fiscal and political constraints. To put it another way, changes in the federal role will be more incremental than desired either by those who wish to hand over most, if not all, current federal infrastructure responsibilities to the states or those who wish to increase the federal infrastructure role significantly.

In light of the range of needs uncovered by the study, the advisory committee proposes that the following guidelines or groundrules govern congressional discussion of possible changes in the federal infrastructure role:

1. Primary responsibility for infrastructure management, financing, and development should continue to rest with state and local governments.
2. The Federal role should be premised on:
    a. *The relationship between infrastructure development and national economic goals.* Federal infrastructure assistance is appropriate if, and when, state or local governments lack the fiscal capacity to revitalize deteriorating infrastructure or cannot easily provide new infrastructure essential to accomodate growth in an efficient or equitable manner. It is clear that Federal support is legitimate to meet national economic development, productivity or job objectives.

    b. *The relationship between state needs and nationally mandated infrastructure commitments.* Federal involvement concerning infrastructure development is appropriate when state and local governments are required to respond to federally mandated infrastructure standards or regulations. For example, federal standards regarding clean water or federal objectives relating to the interstate highway system must continue to be supported with federal assistance.

    c. *The relationship between infrastructure development, or the lack, thereof in one state, to the health and well being of neighboring states.* Pollution and/or congestion, often do not respect state boundary lines. The benefits and/or costs associated with either providing or failing to provide needed infrastructure improvements cannot always be efficiently or equitably distributed among and between contiguous states. Federal infrastructure involvement is appropriate if it reduces the likelihood of significant negative impacts or increases the likelihood of significant positive impacts on broad geographic areas of the nation.

Congressional deliberations should help to establish a sustained federal infrastructure role. Absence of predictability concerning federal commitments will reduce the ability of state and local governments to plan, manage, and invest wisely. The net result will be foregone opportunities and squandered resources.

MAKING THE FEDERAL GOVERNMENT AN EFFECTIVE PARTNER

The advisory committee urges Congress to consider four basic priority amendments to or changes in the current federal infrastructure role. Each is consistent with its findings concerning needs and its perception of groundrules that should govern federal policy. Their implementation will permit the federal government to forge an effective and equitable partnership with state and local governments—a partnership aimed at achieving an efficient and equitable response to national infrastructure objectives as well as state and local government infrastructure priorities.

First, and perhaps central to building a more effective Federal-State-local partnership to meet investment needs, the committee recommends that Congress consider development of a new infrastructure-financing mechanism. Second, to help rationalize federal infrastructure efforts and to help facilitate state and local government infrastructure planning and evaluation efforts, the committee urges Congress to mandate development of a coordinated national infrastructure needs assessment program and unified capital budget evaluation. Third, to help reduce total infrastructure costs and/or to assure that future infrastructure development reflects resource constraints, the committee recommends that Congress, through a prestigious group like the National Academy of Sciences, initiate a review of infrastructure standards. At a minimum, the study would examine the economic, social and evironmental relevance of diverse standards now governing construction of the nations roads, bridges, transit systems, water and sewer facilities. Fourth, to extend more management and planning flexibility to state and local government officials, the committee proposes that Congress mandate an early evaluation of statutory and administrative rules now governing the use of existing federal infrastructure assistance. In addition, the advisory committee recommends that state and local governments make a commitment to enhancing their infrastructure planning, management and financing capacity.

(1) *Creation of a new infrastructure-financing mechanism*

The committee recommends that Congress consider the development of a National Infrastructure Fund (NIF) financed by funds secured through the taxable bond market.

Since the mid-sixties there have been a number of proposals to create national or state infrastructure development banks. Although they differ to some extent, several common themes are apparent. For example, most, if not all, of the proposals would:

(1) Use either federal grant funds or federal debt to help initiate and/or capitalize new financial entities at regional or state levels;

(2) Focus lending by federally-assisted regional or state entities on key infrastructure categories (water, sewer, roads, etc.);

(3) Limit the ability of federally-assisted regional or state entities to substitute federal support for reasonably priced private debt; and

(4) Provide federal subsidies either for specified projects or to lower the cost of loans provided by state or local government financing institutions.

Variations relate to the character of the governing group, the range of objectives to which federal funds could be put, the proposed linkages between existing or new grants, the availability of interest subsidies and loans, and the location of administrative control.

Last year Congress considered a number of proposals to support infrastructure renewal and development. Some involved the use of federal grants while others would have utilized borrowed funds to aid relevant state infrastructure programs. These proposals deserve continued congressional deliberation.

In light of the immense capital needs for infrastructure development, federal help in capitalizing state infrastructure banks or state and local government infrastructure programs is crucial. A number of ways to provide federal capitalization were discussed by the advisiory committee. They ranged from increasing existing grant programs to developing new credit vehicles. After considerable discussion, the committee concluded that Congress should give priority consideration to the development of a National Infrastructure Fund financed by funds secured through the taxable bond market.[1]

The broad goal of the Fund—to help state and local governments finance infrastructure needs—parallels the goals generally embodied in earlier bank proposals. However, the NIF approach is generally simpler and more direct.

Creation of a new National Infrastructure Fund would establish a long-term partnership between all levels of government. It would supplement, not supplant, existing federal aid programs. NIF would provide a means to increase available capital for infrastructure development. It would help state and local governments secure funds at reasonable costs for needed infrastructure improvements. In turn, infrastructure improvements generated by NIF-supported activity would expand national and state economic development options and would help enhance the tax bases of all levels of government.

Without the NIF, or a reasonable alternative, state and local governments would have to rely exclusively on the tax-exempt bond market or they would be required to raise infrastructure funds on a pay-as-you-go basis. Neither alternative would be sufficient by itself in light of the fiscal capacity of some state and local governments, the ability of the tax-exempt market to supply sufficient resources at acceptable rates and the extent and character of the nation's infrastructure problems.

NIF would not fund projects directly. It would raise money by selling taxable bonds directly in the private market or though the Federal Financing Bank. It would use these resources to capitalize state infrastructure-financing (e.g., infrastructure banks) entities or existing state or local government infrastructure programs. If, as proposed by the committee, Congress provided for federal payment of interest on NIF debt, capital could be provided to each state interest-free. In turn, states or their infrastructure-financing agencies could make below-market rate loans to finance certain state or local government infrastructure projects.

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[1] See chapter 5 for a brief discussion of the taxable bond market.

The capital provided by NIF would eventually be repaid by states and localities from varied taxes or user charge revenues. But until NIF was required to repay its bonds, monies earmarked or dedicated by state or local governments to repay NIF loans could be recycled to fund additional projects. Because state and local governments would be required to repay NIF debt, the primary cost, apart from opportunity costs, to the federal government, although not insignificant, would be congressional provision of interest rate subsidies.

There is no absolute wisdom concerning NIF's administrative structure. The NIF could be governed by a board comprised of senior federal, state, and local government officials as well as private sector leaders. NIF could be established as an independent federal entity or placed within the Treasury or other executive branch agency. Congress is best able to determine both the proper administrative arrangements and capital funding limits for NIF.

Congress, as it considers the NIF proposal, might also consider establishing presumptive criteria governing NIF assistance. The Committee recommends that:

(1) NIF's sole function should be limited to providing capital to infrastructure-financing entities to be used in a revolving loan fund to finance specific state and local government infrastucture projects.

(2) NIF should require state and/or local governments to certify that they have the capacity to plan for and manage infrastructure investments as a precondition to loans.

(3) NIF should require firm commitments from states that capital provided by NIF will be repaid on schedule.

(4) NIF should require the project sponsor to certify that they will maintain accounting systems which clearly separate capital from operating expenses which acknowledge asset depreciation.

(5) NIF should require the project sponsor to certify that they have the fiscal capacity to maintain projects financed by NIF.

NIF need not develop an extensive bureaucracy to assure state and local government performance. By and large, recipient certification concerning congressionally defined criteria should substitute for specific paper submittals and subsequent NIF staff reviews. Post-audits concerning the coincidence between statutorily defined performance criteria and experience should occur periodically. They could be initiated by the GAO or a similarly-structured independent audit group.

Because of their visible needs, local governments should have guaranteed access to NIF loan funds. To assure access, Congress should consider a number of options including a percentage set aside for local governments or a guaranteed percent "pass through" from states to local governments.

(2) *Building capacity at the Federal level*

The committee recommends that Congress mandate the coordinated development of an annual national inventory and assessment of basic infrastructure and an evaluation of basic infrastructure conditions.

The nation does not now have the ability to precisely and continuously define its infrastructure needs. As a result, development of coordinated and effective federal, state and local government investment and management strategies is impossible.

This study provides threshold estimates of need. It should be used as a base upon which to build a more refined national assessment of needs and priorities. Ignorance of precise national needs has and will continue to result in wasted resources and opportunities.

Computer technology permits aggregation of relevant and strategic data on a state-by-state as well as a regional basis. Methodological problems illustrated in this analysis can be resolved simultaneously with, and as part of, efforts to initiate this important capacity-building effort.

The committee recommends that Congress require that an analysis of federal capital expenditures be prepared annually as part of the unified budget. No easy way exists to sort out the federal role in infrastructure investment or the impact of diverse federal investment strategies. Congress should insist that the federal budget separate capital expenditures from current operation outlays. It should also require formal development of a unified analysis of federal capital expenditures. The annual evaluation would relate federal infrastructure expenditures to annual national infrastructure need assessments, specific national infrastructure objectives, relevant federal revenue patterns, and an evaluation of past and likely future federal infrastructure aid programs. A recent study authored by a respected group of business and labor leaders stated, "There is a need for a federal capital budgeting process that identifies capital, maintenance, and operating funding requirements; clarifies funding responsibilities between federal, state and local authorities; and assists in the development of a process for setting capital priorities based on objective economic analysis." [2] The advisory committee concurs with this statement. Failure to put the federal house in more rational order will limit state and local government ability to define their own appropriate infrastructure strategies. It will, in addition, frustrate development of effective and efficient federal, state, and local government partnerships.

(3) *Reducing the aggregate cost of infrastructure*

The committee recommends that Congress initiate a comprehensive study of federal standards governing development of basic infrastructure, perhaps through a prestigious group like the National Academy of Sciences. The study would be directed at measuring the relevance of current infrastructure standards in light of changing societal values and real resource constraints. At a minimum, the study would encompass the following: (1) a descriptive inventory of federal standards in key infrastructure categories; (2) an analysis of the relationship of federal standards to relevant state and local government as well as professional standards; (3) an evaluation of the likely impact of federal standards on the overall costs of basic infrastructure to state and local governments; (4) an analysis of the opportunity costs as well as the health, safety and/or environmental risks associated with reducing or amending standards.

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[2] The Labor-Management Group, "A Consensus on Rebuilding America's Vital Public Facilities;" October 1983, p. 8.

Federally mandated standards often dictate the construction "specs" and, to some extent, the average and marginal costs associated with state and local government infrastructure investments. Perhaps this was appropriate when the "Feds picked up the bill". But to many state and local government officials, it seems unreasonable for the federal government to impose mandates without providing financial assistance, or to impose mandates that do not seem directly related to community-based health and safety standards as well as precise local determinations of need.

Historically, development of federal infrastructure standards has been influenced more by professional groups associated with the design and/or construction of infrastructure projects than by consumers. Concern for user safety has been the principal variable driving their form and content. Rarely, however, have they been subjected to a comprehensive evaluation of their economic, social, and environmental benefits and costs, as well.

(4) *Development of more flexible grant programs*

The committee recommends that Congress re-examine statutory and administrative restraints inhibiting flexible state and local government use of existing infrastructure assistance programs.

Governors and mayors interviewed during the course of this study cited the need for a comprehensive review of current statutory and administrative requirements governing existing federal grant programs as a first step toward increasing the flexibility of federal funds. Federal grants, it has been contended, cannot easily be used as loans or to leverage private sector investment. Further, federal statutes do not necessarily meet local needs and priorities, still favor new construction over maintenance activities and frequently prevent the optimal use of scarce state and local resources.

The national government should not unnecessarily restrict the use of funds if, indeed, they are used to meet general statutory commitments or objectives. Similarly, it should not skew the definition of state and local government infrastructure priorities or impede the development and implementation of effective investment strategies by state and local governments. To the extent feasibile, state and local governments should be allowed a freer hand concerning use of existing funds.

(5) *Other considerations—a new look at the Internal Revenue Service Code*

The committee recommends that Congress initiate an evaluation of the tax code, particularly those key provisions affecting financing availability and yields, as well as the benefits and costs of tax-exempt bonds. During the course of the study, the close relationship between the Internal Revenue Service code and the behavior of the municipal bond market became apparent. Clearly, an effort by Congress to rationalize the tax-exempt bond market is in order. State and local governments, however, must be assured of reasonable access to the tax-exempt market for basic infrastructure development purposes. Arbitrary restrictions on the scope, dollar-value, and character of tax-exempt issues should be avoided by the Congress. Congress should make certain that tax-exemption is granted only to debt instruments that clearly fit legitimate public purposes.

BUILDING STATE AND LOCAL GOVERNMENT CAPACITY

The committee recommends that the proposals for federal actions outlined above be premised on state and local government commitments to put their own respective houses in order.

Some state and local governments have developed the capacity to measure and evaluate their infrastructure needs and, as important, have established capital planning and capital budgeting procedures. Despite visible progress, however, tasks associated with building effective infrastructure management and planning and budgeting capacity are still in front of most state and local governments.

Because of the varied conditions in each state, and the related absence of certainty concerning optimum approaches, Congress should not mandate precise prescriptions. However, congressional action, at a minimum, should be matched by the following kinds of state and local government initiatives:

(1) *Efforts to remove inefficient and inequitable legal constraints*

The anti-tax movement and, in some cases, anti-government movement, in many states has understandable roots. Through the sixties and seventies, state and local governments' "own source" revenues and expenditures grew considerably. Expansion of agencies, services, and staff occurred almost uniformly throughout the country. Increasingly, questions were raised concerning whether residents were getting the best buy for their limited dollars, whether new or expanded service were both necessary and effective, whether state and local tax bases were fair and/or efficient. Perhaps unfairly, in some cases, bureaucracy and bureaucrats became the object of scorn.

Clearly, the debate raised over the role of government, by and large, has been a healthy one. Just as clearly, however, the often spontaneous and underevaluated responses in some states and municipalities has made it difficult for public and private sector leaders to respond to legitimate state and community needs. This is particularly true with respect to infrastructure.

Fixed lids on public expenditures and/or revenues have been added to the constitution or have been the subject of legislative mandates in many states. Similarly, varied kinds of limits have been placed on public sector debt in some states—limits that often go beyond the conventional relationship between borrowing and taxes. Finally, "extraordinary" majorities have been required in many communities to pass bond issues.

For the most part, arbitrary government spending and/or revenue constraints have not generated good or better government. Rather, they have caused many state and local governments to postpone necessary maintenance on roads or developing new highways or needed water treatment facilities essential to economic development. They also have limited the ability of many governors, mayors and managers to efficiently manage scarce public resources.

State and local governments should initiate evaluations of provisions—both constitutional and legislative—which appear to inhibit efficient and equitable responses to infrastructure problems. Democracy is not served well in cities, like Seattle, if a minority of voters can frustrate the majority's desire to secure debt financing to address the city's deteriorating bridges, roads, and other public facilities. Efficiency is not achieved in states, like California and Massachusetts, with rigid limitations on property taxes if, as a result, cities and towns find it difficult to develop proper capital budgets or necessary infrastructure investment strategies. Effective management is not served, if, because of arbitrary debt limits, new special purpose governments must be created to borrow funds and initiate proper infrastructure development options.

(2) *Improved management, planning and budgeting*

Development of better national needs assessment techniques and a federal capital budget analysis should be complemented by state and local government initiatives to improve infrastructure planning and budgeting processes. Presently, as illustrated in this study, many states and localities do not know the precise condition of their roads, sewer treatment facilities, water supply and distribution systems. In turn, very few state and local governments can project future needs or revenues. Effective, coordinated capital planning and budgeting capacity is a rare phenomenon. Investment strategies, when they exist, more often than not, fail to accommodate depreciation of capital assets as an annual cost of doing business and generally overlook maintenance and facility revitalization costs.

States and localities should be asked to immediately put in place sound infrastructure planning, budgeting and investment procedures. Failure to do so, increasingly, will result in difficulties in marketing long- and short-term debt. More relevant, perhaps, failure to do so will result in inefficient use of scarce public and private sector resources.

Although the methodology is complex, the steps required to improve state and local government planning and budgeting capacity are relatively clear cut. They involve:

(1) Initiation of a continuous process able to define infrastructure conditions and anticipate infrastructure needs.

(2) Development of a continuous coordinated planning process capable of defining long and short term infrastructure goals, priorities, and programs.

(3) Development of a capital budgeting process that distinguishes capital investments from operating expenditures, that acknowledges asset depreciation, that weighs revenue options,

and that illustrates the "opportunity" costs of investment alternatives.[3]

(3) *More effective use of other financing techniques*

Although many states and some local governments have been diversifying their financial techniques, a large number have not demonstrated an interest in new and available financing tools. In some cases, constitutional and/or legislative constraints prevent them from doing so; in other cases, communities may not be fully aware of the range of opportunities that exist.

No national prescription can be made with respect to state and local choices concerning financing options. Variables, often indigenous to each area (e.g., budget and revenue as well as political and institutional constraints, etc.), obviously, will influence state and local strategies. But increased use of several alternatives should be considered by state and local governments. Among them:

1. *Increased use of user fees* [4]

Many states and localities have increased their reliance on user fees and/or special dedicated revenue sources. The Joint Economic Committee's annual report on the fiscal condition of cities indicated that, from 1980–1981, user fees increased from 5.9 percent of local revenues to 6.3 percent. First-time fees have been charged in some areas for trash collection, recreation services, and attendance at museums, etc. Many municipalities have moved toward pricing the delivery of water, based on full costs, including the costs of operation and maintenance, debt service and maintenance/replacement. Other communities have increased already-existing fees on some basic services like transit. Numerous local governments have asked developers to "front load" a larger share of the infrastructure burden either directly or through increased fees. Increased reliance on user fees may not always be appropriate for each community, but deserves increased consideration. Their specific use should reflect the following ground rules:

> Fees should be established based on consideration of marginal, not average, costs.
>
> Fees should be linked, to the extent possible, to actual users and bear some relationship to extent of use.
>
> Fees should acknowledge the elasticity of services, that is, fee increases should not be applied to basic or essential services, if their application would lead to a significant decline in use and frustrate state and municipal objectives.
>
> Fee structures should accommodate the needs of low income households and needy communities. Equity concerns mandate reasonable access to basic services by both groups at reasonable cost levels.

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[3] The Ford Foundation has provided the National Infrastructure Advisory Committee with funds to develop a capital budget/needs assessment handbook for state and local governments.

[4] The discussion of financial alternatives benefits from papers prepared by Lehman Brothers Kuhn Loeb Inc., and Smith Barney, Inc.

2. *Earmarked or dedicated taxes*

Earmarked, or dedicated, taxes have provided many states and localities with the flexibility to develop new and/or to improve existing infrastructure. Revenues provided by such taxes have permitted the direct implementation of predictable and sustained work programs for highways, water supply and water distribution improvements. Because they also have been used to assure or guarantee repayment of debt, they have expanded state and local government access to credit markets.

Some problems accompany the use of earmarked taxes. For example, they "lock-in" revenue and expenditure patterns making it difficult for state and local governments to efficiently and equitably manage total budgeting needs. In a similar vein, they sometimes hide or blur total tax burdens. If not structured carefully, they may not be able to resist cyclical economic changes. For example, revenues from gas or motor fuel taxes in many states have declined, in some cases precipitously, because of the direct link between the tax revenues and gasoline consumption.

3. *Tax increment financing*

Tax increment or tax allocation bonds have a long history. They were pioneered in California during the early fifties. They essentially permit a governmental unit to finance the costs of infrastructure from the revenues associated with increased taxes from the benefits area. "The credit of the bonds . . . depends on the likelihood that property values will increase as a result of the project and on the commitment of commercial and industrial enterprises to operate in the district." [5]

Success concerning tax increment financing is dependent on a variety of complex factors. Obviously, communities must guess right concerning anticipated tax increases and likely purchasers of bonds must accept respective community analyses. Perceived risks concerning future development will increase interest rates and/or limit market accessibility.

Defining appropriate tax districts has lead to difficulties for some communities. They have found it difficult to determine the appropriate flow of benefits to land owners and/or users for tax rate and tax allocation purposes. Similarly, some areas have found it troublesome to determine the allocation of revenues as between the district and the general community. Beneficiaries of taxes (e.g., school districts) from the proposed district sometimes complain about the assumed reduction of potential revenues resulting from use of tax increment financing.

4. *Other financial alternatives*

Numerous innovative debt instruments or debt creating mechanisms have been created to respond to the recent inaccessibility and/or high cost of conventional long-term tax-exempt bonds. None are perfect. Their use should generate from analysis of likely benefits and possible costs.

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[5] Comments in the draft background paper submitted to the National Infrastructure Advisory Committee and staff by Lehman Brothers Kuhn Loeb Inc.

Short-term debt

Several governmental entities have experimented with tax-exempt commercial paper and/or bond/grant anticipation notes. Short-term, rollover or bridge loans permit localities to initiate work on capital projects. Secured funds permit them to avoid the costs of inflation, often resulting from postponing development and/or the costs to the community associated with continued deterioration of varied infrastructure components. Put another way, availability of short-term debt permits a community or area to strategically plan and/or initiate relevant growth and/or revitalization work programs. They can "choose when to enter the long-term market . . . when to convert short-term to long-term debt."[6] If long-term rates decline and/or if the differences between short- and long-term rates narrows, state and cities can adjust their mix of long- vs. short-term debt.

Expanded use of short-term debt is not without risks. Should long-term interest rates remain high, and/or increase over the time, borrowers could be faced with higher net costs and/or narrow long-term financing choices. Similarly, should use of short-term credit for permanent capital outlays become a habit, state and local budgeting processes would become overly complicated and lead to possible recurring fiscal crises.

Long-term borrowing

Adjustable or floating fixed-rate bonds have proved helpful in many areas. Basically, both transfer the risk of interest rate changes to the borrower and both provide the investor with increased liquidity. As a result, both increase state and local government access to credit markets.

Interest on floating rate bonds are generally based on a defined index of related or similar kinds of securities. Interest rates on adjustable bonds are determined at stated periods of time, during the life of the issue. Changes generally are premised on the interest on long-term debt.

Adjustable and/or floating-rate bonds may well help state and local governments respond to their infrastructure related priorities. Their use, however, should be premised on the availability of reasonably sophisticated fiscal management capacity. Favorable rates are crucial to making each instrument work for the borrower. The interest rates in floating-rate bonds, given their basic structure, varies more than adjustable rate bonds. Both, however, require expert knowledge of market conditions (present and future), both require skillful negotiations concerning rate setting, maturities, possible rollover and "put" options.

Leaseback arrangements

Congressional concern over the costs to the Treasury resulting from increased state and local government use of tax-exempt leases and sale-leasebacks has made both approaches to infrastructure financing visible. Currently, given present tax laws, they offer alternatives to governmental entities seeking to initiate comprehensive and/or strategic infrastructure development programs.

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[6] Ibid.

Lease-purchase agreements permit leasors to secure tax-exempt income and, as a result, reduce rent or lease costs to the public sector. Possibilities concerning installment purchases may permit state and/or cities to secure facilities without formally or "technically" requiring extensive debt.

Sale-leasebacks, as the name suggests, occur when a public entity sells a facility to private investors. In turn, the investors lease the facility back to the public sector. Advantages accrue to both lessor and leasee. For example, the new owners often are able to secure investment tax credits as well as depreciation allowances, and the involved government is able to minimize debt, raise capital equal to the value of future tax benefits, and gain relatively low lease payments.

While increasingly popular, there are some costs. The failure of state and local governments to use leasebacks for priority needs, particularly with respect to core or basic infrastructure, raises legitimate equity and efficiency concerns for Congress. The federal Treasury, in these instances, is being asked to pick up the costs of often non-essential local projects. In light of on-going Congressional debate, uncertainty exists relative to the availability of future tax incentives and may place at risk communities dependent on this approach. Similarly, leaseback options, if not carefully examined, may skew local budgeting processes and investment patterns. Without careful examination, they could also result in higher costs than would occur if a blending of short- and long-term debt instruments were used by state and local governments.

State or regional bond banks

State bond banks can lower local government borrowing costs by "pooling" a large number of small local government issues into one larger bank issue. The issue is then sold in the market through a negotiated sale or competitive bid. The bond bank achieves its savings through economies of scale in underwriting (one large issue rather than many small ones) and enhanced marketability (by increasing issue size, pooling risk, and increasing attractiveness in the secondary market). Currently, bond banks operate in Vermont, Maine, Alaska, North Dakota, New Hampshire, and Puerto Rico, and modified versions can be found elsewhere

Existing banks have been authorized by state legislatures. Start-up costs (seed money) are generally provided through appropriations or loans. Participation by local government is optional, but not automatic. The local jurisdiction must apply for a particular issue and the bank may accept or reject the application. Over a period of time, usually between three and six months, the bank collects a number of these small issues and then issues its own bonds in an amount equal to the aggregated amount of small issues, plus an increment to finance a reserve fund equal, typically, to the maximum annual debt service. Operating expenses of the bank are typically covered by earings on the reserve fund (whose assets are invested in interest-bearing U.S. Government securities). Defaults of individual participants, not covered by the reserve fund, may be paid off by assessing financially able past or present participants.

Various studies have shown that bond banks have successfully lowered borrowing costs for small, low-rated or unrated jurisdictions. The general conclusion appears to be that this form of financial intermediary has the most significant potential for success in states or regions with disporportionately large numbers of small municipalities with low (or no) credit ratings.

Despite what may seem to be obvious advantages of bond banks, they have not proliferated rapidly in the United States. Economically viable localities resist "supporting" less creditworthy counterparts. Further, opposition to bond banks, in some areas, is substantial among local bankers, bond counsels, and investment bankers who perceive this new institution as an intrusion on their business. Finally, many local governments fear departing from current borrowing patterns, and resist a state role.

An often overlooked advantage of the bond bank is that it can provide financial expertise to small, unsophisticated government units. Many argue, in fact, that this is the primary benefit Another is that bond banks can function even in those states which have constitutional or statutory restrictions on the issuance of general obligation debt. The bank, often, is not an integral part of state government.

One approach to bond-banking currently under consideration is the New Jersey Infrastructure Bank (NJIB). Much attention has been focused recently on the infrastructure bank proposed by Governor Thomas Kean of New Jersey. Essentially, the NJIB would operate as a non-profit financing vehicle for addressing the infrastructure problems is New Jersey. The bank would be capitalized primarily through proceeds from state bond issues, through federally provided capital and through state appropriations.

Once established, the bank would use a "revolving" loan system to finance designated types of projects. The funds would be "borrowed" by local government units at a low (or no) rate of interest to finance a certain share of project costs. As loans are repaid, proceeds are reloaned to finance other infrastructure projects.

Appendix A. STATE PROFILES

This report has been based on studies prepared in 23 states by local researchers. The reports were based on interviews with state and local officials and a review of available data including capital plans, needs assessments and inventories of condition. Time and budget precluded the development of independent assessment of condition, needs or revenues. To the extent possible, researchers adhered to a common format. They extrapolated information from available reports to a common timeframe (1983-2000) and constant 1982 dollars.

The state profiles which follow were prepared by the staff of the University of Colorado at Denver based on the case studies submitted by the state researchers. For the most part, the profiles are simply summaries. But in some instances, adjustments have been made to enhance methodological and conceptual comparability.

The state profiles are presented in alphabetical order.

ALABAMA[1]

Profile of State Infrastructure Requirements

I. CONTEXT

Alabama has faced difficult economic times in recent years. The state experienced strong economic growth between 1970 and 1979. During this period the state economy grew at a faster pace than the national economy as a whole; however, over the past three years, the reverse has been true. During 1982, for example, the state unemployment rate rose dramatically and was the second highest in the nation.

These trends are largely attributable to the fact that Alabama relies heavily upon sectors (i.e., construction, manufacturing) of the economy which are particularly sensitive to high interest rates and tight monetary policies that have characterized the recent recessionary period.

Total Alabama tax revenues have shown widely fluctuating growth patterns in recent years. Revenues increased by 4.8 percent in 1982, but increased by 12.2 percent in 1981, 7.0 percent in 1980 and 10.6 percent in 1979. The gain in 1981 was influenced by oil lease revenue and a change in reporting of income tax withholding. Annual average growth in state tax revenues is forecast at 11.8 percent during the 1983 to 1991 period. Total tax revenue is projected to be $2.5 billion in 1983, increase to $3.9 billion in 1987, and grow to $6.1 billion in 1991.

II. FUNCTIONAL DESCRIPTIONS

The study of state infrastructure needs relied on readily available secondary source data. It was found that, in almost all instances, estimates of future needs and resources were not available. No attempt was made to generate any estimates beyond those already available.

A. Transportation

The transportation component of the state's infrastructure covered highways, bridges, airports, railroads and ports.

1. *Highways and bridges.* The trafficways in Alabama consist of 87,483 miles of state highways, county roads and city streets. The state highway system consists of 20,708 miles of interstate routes; federal-aid primary, secondary, and urban highways; and 66,775 miles of local roads. Approximately 25,000 miles are not paved. The state also has 15,187 bridges; of these, 5,007 are maintained by the Alabama Highway Department, 9,373 by counties, 777 by municipalities, and 30 by railroads.

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[1] Based on the Center for High Technology Management and Economic Research, School of Administrative Science, The University of Alabama in Huntsville, "Infrastructure Needs and Resources of Selected State and Local Government Programs in Alabama," September 1983.

Total state and local expenditures were $620.8 million during the 1980-81 year. Of this, $326.4 million was for capital outlay. The state government provided 87 percent of the capital expenditure in 1980–81. On a per capita basis, Alabama capital outlays for highways were $83.82 compared with a U.S. figure of $85.34 in 1981.

One source indicates that 66 percent of the paved roads and 45 percent of the bridges in the state are deficient. In 1979, the Alabama Highway Department conducted a 20-year highway systems needs survey which indicated that $3.7 billion will be needed over the 1980 to 1999 period to improve the state system (excluding the interstate) to the American State Highway Transportation Officials standards. To complete the remaining miles of the state interstate system, it will cost an estimated $970 million in 1981 dollars. County roads in need of resurfacing will cost $284 million.

A 1981 survey of bridges in the state revealed that 53 percent of the county-maintained 9,373 bridges are structurally deficient or functionally obsolete by Federal Highway Administration criteria. Replacement costs are estimated to be $413 million. The highway department has estimated that $672 million will be required to bring all bridges in the state up to standard.

The total cost to maintain the existing Alabama highway and bridge system is $4.2 billion during the 1981 to 2000 period. An additional $6.7 billion will be required to improve the system. The total cost, including an additional $817 million for O & A costs to maintain and improve the system, is estimated to be $11.8 billion.

A $0.04 increase in the Alabama gasoline tax went into effect in 1981 and has resulted in an additional $31.5 million in revenue to the highway department. The Surface Transportation Act of 1982 provides for an additional $0.04 per gallon gas tax to be allocated for federally aided trafficway systems. With these new sources of revenue, the 1981 to 2000 state revenue should approximate $8.7 billion, or about $3.1 billion short of the needs estimate.

2. *Railroads.* With 4,497 miles of track in 1979, Alabama ranked 18th among the states in terms of the extensiveness of its rail system. Compared with other southeastern states, only Georgia's rail mileage exceeds that of Alabama. The state is served by 21 railroad companies. The Alabama Highway Department is the designated state agency concerned with rail planning and prepares the State Rail Plan. It is estimated that $15.3 million is needed in rehabilitation assistance.

3. *Mass transit.* Public transit service with regularly scheduled bus lines is provided in five Alabama cities. Combined with the small size of these systems is the general trend toward reduced ridership. Consequently, the probable shortfall in funding by 2000 could not be more than $2 million in 1980 dollars and is insignificant compared with other infrastructure requirements in the state.

4. *Airports.* Alabama has a State Airport System Plan. The Department of Aeronautics has general supervision over all phases of civil aviation in the state. There are 103 airports in the state, including five military airports. In 1973, the state studied its airports and found 82 airports to be essential to the State Airport System Plan. The only source of revenue for the Department of Aeronatics' airport construction program and operating expenses are the aviation fuel taxes. In addition, the legislature provides the department with $600,000 yearly. Larger airports go directly to the federal government for grants to improve and maintain their facilities. Revenue between 1980 and 2000 is projected to be $1.7 billion; no cost estimates associated with needs are developed.

5. *Water transport and terminals.* Alabama is third in the nation in terms of navigable waterways and has the potential to move into first position. Today's 1,300 miles of nine-foot channel will be extended to 1,700 miles within a few years. It is anticipated that the fee structure for the port facilities will be sufficient to satisfy future needs.

B. Water Supply, Distribution and Treatment

Alabama has an abundance of streams and lakes and an adequate annual rainfall. The source of water in the state is from both streams and wells. The Alabama Public Water Systems have a continuing need to improve existing Public Water Systems Treatment Plants. There are 700 community public water systems in the state. In addition, there are 151 non-community public water systems serving smaller communities. The Alabama expenditures for water supply were $142 million in 1980–81 of which $35.6 million were for per capita outlay. On a per capita basis, Alabama's capital outlays have not been dissimilar from national averages in recent years:

PER CAPITA CAPITAL OUTLAY FOR WATER SUPPLY

Fiscal year	Alabama	National
1977-78	$11.41	$9.80
1978-79	10.93	13.14
1979-80	16.20	14.43
1980-81	9.14	16.41

C. Wastewater Collection and Treatment

There are 281 sewerage treatment facilities in Alabama, all owned by municipalities, towns, and villages which they serve. An inventory of waste treatment systems as of September 1981 indicated 10 municipal facilities were under construction at a total estimated cost of $83.7 million. A large number of Alabama's waste treatment facilities will have to be upgraded or replaced over the next several years in order to meet treatment requirements. These needs are the result of development of criteria for secondary treatment under the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) and subsequent adoption of essentially the same criteria by Alabama. Currently, there is no state financing available for sewer plant construction or maintenance. EPA construction grants are estimated to be $27.3 million in both fiscal year 1984 and 1985.

On a per capita basis, Alabama's capital outlays have been substantially lower than national averages in recent years:

PER CAPITA CAPITAL OUTLAY FOR SEWERAGE TREATMENT FACILITIES

Fiscal year	Alabama	National
1977-78	$17.79	$28.43
1978-79	13.77	33.19
1979-80	14.57	31.84
1980-81	13.30	32.45

The Alabama Water Improvement Commission (A WIC) administers the federal grant program under which funds are allocated to state municipalities. Based on a 1981 A WIC needs survey, Alabama will require about $935 million in capital improvements between 1982 and 2000 to meet the EPA requirements. It is projected that federal and local revenue will be $529 million and $250 million respectively over the 1981 to 2000 period in 1981 dollars. Thus, there is a shortfall of $156 million.

III. Summary and Conclusions

The total of all state infrastruture needs is $12.8 billion in 1980 dollars. Estimated unmet needs are $3.2 billion:

A SUMMARY OF INFRASTRUCTURE NEEDS IN ALABAMA (1983-2000)

[In millions of 1982 dollars]

Infrastructure	Estimated needs	Estimated revenues	Estimated revenue shortfall
Trafficways	11,756	874	(3,016)
Rail	15	N/A	N/A
Mass transit	N/A	7	N/A
Airports	N/A	1,661	N/A
Water transport and terminals	N/A	N/A	[1] 0
Water systems	100	N/A	N/A
Sewarage systems	935	779	(156)

[1] Approximate.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF ALABAMA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$153	$14	$18	$186	$371	$389	$443	$44	$53	$541	$1,033	$1,086
1970	169	14	21	204	372	393	445	41	57	543	959	1,016
1971	201	15	22	238	430	452	485	38	56	579	1,026	1,081
1972	188	8	18	214	448	465	435	19	42	495	1,009	1,051
1973	174	9	22	204	441	463	377	19	49	445	933	982
1974	211	10	23	244	559	582	357	19	44	420	1,004	1,048
1975	222	21	32	275	616	647	350	36	52	437	1,013	1,065
1976	268	33	24	325	671	694	427	52	36	515	1,072	1,108
1977	266	60	34	360	676	710	408	89	50	548	1,022	1,072
1978	280	47	43	370	681	723	361	64	57	482	919	976
1979	261	40	41	342	641	682	282	48	50	381	762	812
1980	266	49	63	379	731	794	252	55	70	377	779	849
1981	326	49	36	411	793	829	311	51	37	399	806	843

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,399	130.44	13.06	15.57	159.07	303.83	319.39	0.41	0.04	0.05	0.50	1.00
1970	3,444	129.19	11.90	16.59	157.68	278.47	295.06	.44	.04	.06	.53	1.00
1971	3,489	139.09	11.03	15.94	166.05	293.99	309.93	.45	.04	.05	.54	1.00
1972	3,533	123.00	5.33	11.89	140.22	285.55	297.44	.41	.02	.04	.47	1.00
1973	3,578	105.33	5.20	13.83	124.36	260.75	274.58	.38	.02	.05	.45	1.00
1974	3,622	98.56	5.24	12.18	115.98	277.08	289.26	.34	.02	.04	.40	1.00
1975	3,667	95.41	9.68	14.13	119.22	276.20	290.33	.33	.03	.05	.41	1.00
1976	3,712	115.04	13.98	9.81	138.83	288.83	298.63	.39	.05	.03	.46	1.00
1977	3,756	108.60	23.82	13.35	145.77	271.96	285.31	.38	.08	.05	.51	1.00
1978	3,801	95.06	16.83	14.99	126.87	241.83	256.82	.37	.07	.06	.49	1.00
1979	3,845	73.31	12.60	13.04	98.96	198.03	211.08	.35	.06	.06	.47	1.00
1980	3,890	64.79	14.21	18.03	97.03	200.34	218.37	.30	.07	.08	.44	1.00
1981	3,935	79.13	13.03	9.36	101.52	204.89	214.25	.37	.06	.04	.47	1.00

CALIFORNIA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Context

California, with a population of 24 million in 1980, is among the largest of states. Its economic performance is generally stronger than that of the nation both in good times and bad. The state has enjoyed rapid growth over an extended period. During the seventies, state population grew by 18.5 percent in contrast to the 11.4 percent increase in U.S. population.

The forecast for the state is for continued growth above the national average. Wage and salary employment is projected to increase at an average annual rate of 1.8 percent through 2000. Personal income is projected to grow 8.8 percent per year.

B. Fiscal Context

Despite a generally strong economy, the state's governments have been subject to some fiscal stress resulting from tax and expenditure limits put in place via referendum.

Most notable is Proposition 13, enacted in 1978, which reduced ad valorem property taxes by more than 50 percent. The effects of the limit were initially offset by increases in state aid, but local governments must now cope with the reduced revenue base. They have done so, in part, by increasing user fees and charges. One impact of Proposition 13 of special importance for infrastructure financing is that it limited the ability of local governments to issue general obligation debt. In 1982, general obligation debt made up less than 1.2 percent of the total issued by California local governments.

A second fiscal limit—Proposition 4—was voted in place in 1979. This limits the annual growth of certain appropriations at both the state and local level to the increase in population and cost of living. The effect on infrastructure should not be too great since payments for debt service and some revenues—including certain user charges and fees—fall outside the limit.

C. Capital Planning and Budgeting

Responsibility for infrastructure planning, budgeting and management is fragmented. Responsibility is shared among state and local governments, special districts and private firms. There is, therefore, no reliable, complete and consistent data on past investments, future requirements or revenues.

II. HISTORICAL CAPITAL INVESTMENT

From 1970–71 through 1982–83, annual expenditures for infrastructure rose 168 percent, from $2.6 billion in 1970–71 to about $7.0 billion in 1982–83.

Public transit registered the highest relative increase; state highways the lowest. The increase in overall spending, however, was not sufficient to offset the effects of inflation. Measured as a share of gross state product, infrastructure expenditures have decreased from 2.2 percent in 1970–71 to 1.8 percent in 1982–83. As a share of total state-local expenditures they decreased through the mid-seventies from 12.8 percent in 1970–71 to 9.4 percent in 1976–77. Since then the percentage has been rising but remains below the level of commitment found in the early part of the decade.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* California's road system consists of over 180,000 miles of highways. Approximately 15,000 miles of pavement are a part of the state highway system; the remainder is the responsibility of city and county governments.

No information was presented on the condition of the state highway system. The state department of highways, however, estimates a backlog of needs of approximately $14.5 billion and annual growth needs of $543 million. This results in a total estimate for the projection period of 1983 to 2000 of approximately $24 billion. Revenues are estimated to total $1.12 billion per year from all sources. This leaves a likely revenue shortfall of $4 billion.

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[1] Based on California Debt Advisory Commission, Office of the State Treasurer, with the assistance of the Department of City and Regional Planning, University of California, Berkley, "California's Infrastructure Study" (Preliminary Draft).

Information on city and county roads is based on a recent survey of local officials. When asked about the overall condition of city streets and county roads, a little over half rated each category as "fair." For the city streets, the next most common response (29 percent) was "good," but for county roads, 27 percent responded they were in "poor" condition. City officials reported that the typical street was resurfaced every 35 years. The desired frequency of asphalt resurfacing is 16 years.

Local officials reported average annual investment needs of $335.8 million for city streets and $359.3 million for county roads. If these estimates, which were based on a 10-year time frame, are applicable through 2000, then $12.5 billion in capital investment is needed on this part of the California road system. Also relying on survey responses, revenues for city and county roads were estimated to total $5 billion through the year 2000, leaving a shortfall of $7.5 billion.

2. *Mass transit.* California has 200 transit systems which provided 766 million passenger trips in 1980. A survey of transit system officials suggests that the vehicles and guideways comprising the system are in generally good condition. These same officials foresaw annual investment needs of $890 million per year, which if extrapolated over the study period, results in a total needs estimate of $16 billion. Most of the funds would be used for vehicle replacement. Revenues of $561 million per year are anticipated by transit officials with a greater share provided by farebox revenues and local government support than has been true in the past. Through 2000, revenues are estimated to total $10.1 billion, approximately $6 billion less than required to meet needs.

3. *Railroads.* California has an extensive rail system. Intercity or interstate passenger rail service is provided on seven lines. There are three intracity or rail transit systems operating (BART, San Francisco municipal railway and San Diego Trolley), and several additional systems are being planned. The state rail freight network includes 8,312 miles of line. No estimates of need or revenue were provided for any aspect of the rail system.

4. *Airports.* The aviation system consists of 295 public-use airports—214 of which are publicly owned. Over 80 million passengers emplane annually. Within the next 10 years, 30 percent of all airports will reach or exceed their original design life. Nearly 60 percent are expected to deteriorate to unacceptable levels.

The state transportation department estimates their role in meeting general aviation needs over five years at $22.6 million. If this level of need recurs over the longer timeframe of this study, an investment of $81.4 million would be required. Revenues over the same period are expected to total $29 million.

In general, large commercial airports are well-financed while smaller general aviation facilities are not. No estimates were provided on the total investment needs of the overall airport system.

B. Water Supply, Distribution and Treatment

The state, federal and local governments all have played a role in meeting California's water needs.

The state's urban water system contains over 80,000 miles of water mains which distrubute water to six million service connections. These urban water mains are estimated to have a replacement cost of over $100,000 per mile.

The state water project consists of 21 reservoirs with a capacity of 6.8 million acre feet and 640 miles of aqueduct. The state also plays a role in water systems by helping finance local efforts to improve the quality of drinking water. In 1975, when the state passed a bond issue to finance the latter program, it was estimated that 80 percent of all domestic water suppliers were deficient in primary and/or secondary drinking water standards.

Two estimates were developed for the water supply function. The first was based on the state's role. It assumes investments of $712 million required in the state water project and $1.1 billion to upgrade drinking water to meet public health standards. No revenues are assumed to be available for state water project needs since the original bond issue is nearly exhausted. Existing and proposed state bonding will provide approximately $280 million to meet water treatment needs.

An alternative estimate of need is based on a state survey of water system administrators. It assumes a backlog of needs of $7 billion and an annual growth figure of $409 million, resulting in a total needs estimate through 2000 of $14.4 billion. Water officials anticipate revenues totalling $5.3 billion through 2000.

C. Wastewater Collection and Treatment

In California, wastewater collection and treatment is a local responsibility, generally undertaken through special districts. The state plays a role in administering the federal grant program and, using bond proceeds, in financing part of the nonfederal share of grant-eligible projects. While existing bonding authority has mostly been used, a new bond issue is likely to go to the voters in 1984.

Two estimates of need are provided. The first is based on the EPA Needs Survey which projects needs in 2000 of $5.6 billion. The second, based on a state study, yields a much higher estimate—$17.4 billion. This is based on current needs of $9.5 billion and an annual growth figure of $441 million.

A range of revenue estimates were provided. One estimate is driven by the availability of federal funds and assumes that no money would be available after 1985. This results in an extremely low estimate of revenues—$300 million over the projection period. The state study, which estimated total needs of $17.4 billion, anticipated revenues from all sources of $10.9 billion.

IV. SUMMARY AND CONCLUSIONS

California's infrastructure investment needs through 2000 are estimated to total $80.5 billion. Estimates of available revenue are $48.2 billion.

CALIFORNIA'S INVESTMENT REQUIREMENTS AND ANTICIPATED REVENUES, 1983–2000

[In millions of 1982 dollars]

	Needs	Revenues
Highways and bridges	34,225	22,688
Mass transit [1]	15,152	9,532
Airports [2]	73	26
Wastewater	16,982	10.647
Water	14,035	5,281
Total	80,467	48,174

[1] Rail transit included.

[2] State responsibilities only.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF CALIFORNIA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$1,055	$92	$231	$1,378	$2,673	$2,904	$3,053	$290	$674	$4,017	$7,448	$8,122
1970	1,164	102	256	1,523	2,737	2,993	3,062	297	708	4,067	7,051	7,758
1971	1,151	135	235	1,521	2,761	2,996	2,774	353	597	3,724	6,586	7,183
1972	1,170	164	237	1,572	2,605	2,843	2,708	387	563	3,658	5,873	6,436
1973	960	143	219	1,323	2,468	2,687	2,085	314	488	2,887	5,218	5,706
1974	922	187	300	1,409	2,806	3,106	1,562	355	575	2,493	5,035	5,611
1975	1,000	294	360	1,654	3,368	3,728	1,577	497	587	2,661	5,540	6,127
1976	881	406	296	1,582	3,555	3,851	1,402	645	456	2,503	5,683	6,139
1977	656	401	302	1,359	3,164	3,466	1,005	600	445	2,050	4,780	5,225
1978	823	379	294	1,496	3,482	3,775	1,062	517	392	1,970	4,702	5,094
1979	853	562	320	1,735	3,514	3,834	922	683	389	1,994	4,175	4,565
1980	1,047	558	318	1,922	4,235	4,553	990	625	354	1,969	4,515	4,869
1981	1,092	552	513	2,157	4,735	5,249	1,042	581	531	2,153	4,812	5,343

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	19,601	155.74	14.79	34.38	204.92	379.99	414.37	0.38	0.04	0.08	0.49	1.00
1970	19,971	153.30	14.89	35.43	203.62	353.04	388.46	.39	.04	.09	.52	1.00
1971	20,341	136.40	17.34	29.33	183.07	323.78	353.12	.39	.05	.08	.52	1.00
1972	20,711	130.77	18.68	27.19	176.64	283.55	310.74	.42	.06	.09	.57	1.00
1973	21,080	98.89	14.90	23.16	136.95	247.52	270.68	.37	.06	.09	.51	1.00
1974	21,450	72.84	16.56	26.81	116.20	234.75	261.56	.28	.06	.10	.44	1.00
1975	21,820	72.28	22.78	26.88	121.94	253.91	280.80	.26	.08	.10	.43	1.00
1976	22,190	63.16	29.08	20.57	112.81	256.09	276.66	.23	.11	.07	.41	1.00
1977	22,560	44.55	26.58	19.74	90.87	211.87	231.61	.19	.11	.09	.39	1.00
1978	22,929	46.31	22.54	17.08	85.93	205.07	222.15	.21	.10	.08	.39	1.00
1979	23,299	39.59	29.31	16.71	85.60	179.20	195.91	.20	.15	.09	.44	1.00
1980	23,669	41.85	26.40	14.94	83.19	190.78	205.71	.20	.13	.07	.40	1.00
1981	24,039	43.33	24.15	22.09	89.58	200.18	222.28	.19	.11	.10	.40	1.00

COLORADO [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economy

Colorado has enjoyed rapid growth over the past 20 years. Population has increased by an average of 2.5 percent per year, compared to a national growth rate of one percent. During the latter half of that period, growth has been driven by an energy boom affecting the Western Slope, where natural resources are mined, and the Front Range, where front office operations have expanded. Employment growth has also been rapid. During the 1970s over half a million jobs were created and the average annual growth in employment was three percent greater than the national average.

In the next 20 years, Colorado is expected to continue growing but at slower rates than in the past. Population will grow at a rate twice that of the nation and reach 4.5 million by 2000.

B. Fiscal Constraint

Colorado is conservative with respect to public spending. Since 1977 the state government has been operating under a statute limiting the growth in general fund expenditures to seven percent per year. There are also limits on local property tax levies. As a result of these fiscal constraints, the government sector in Colorado has been shrinking. Over a six-year period, state spending has declined from 5.2 percent of personal income to 4.1 percent.

C. Capital Planning

Given the rapid rate of change in Colorado, there is a high level of concern regarding capital needs. There is also a relatively large amount of information developed primarily through ad hoc planning efforts rather than an institutionalized capital planning and budgeting process. Two planning efforts are especially noteworthy. First, a cumulative impact task force, comprised of energy industry officials and state and local government officials, worked hard to assess the impacts of energy development and determine the need for investment in public infrastructure in several Western Slope counties. Second, a Blue Ribbon Panel, consisting of public and private leaders, was appointed by the governor in 1979 to advise him on capital needs statewise. This panel developed much of the information used in this case study.

Partially as a result of a recommendation by the Blue Ribbon panel, the governor has prepared a five-year capital investment budget for the past two years. In Colorado, however, the legislature dominates the budget process, and until they embrace the concept of capital budgeting, the planning process will have limited impact.

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and Bridges.* Colorado's road system consists of 9,200 miles of state highway, 56,400 miles of county roads and 8,500 miles of city streets.

The state highway network operates under the guidance of a highway commission which adopts its own budget independent of both the legislative and executive budgeting processes and allocates earmarked revenue from the State Highway Users Trust Fund and from federal sources. The Highway Users Trust Fund is derived from a per gallon-tax on gasoline, from vehicle registration and driver's license fees and from a gross ton-mile tax on truck freight. In recent years, these dedicated revenue sources were supplemented by legislative appropriation. The viability of the trust fund has been enhanced by legislative action which recently raised the gasoline tax from seven cents to nine cents per gallon.

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[1] Based on James M. Ohi "Colorado Public Infrastructure Needs and Capital Investment Planning and Budgeting Process: A Case Study" (Denver, Colorado: Center for Public-Private Sector Cooperation, University of Colorado at Denver), October 1982. The analysis of highway needs presented in the profile has been updated based on unpublished analysis prepared by the Office of State Planning and Budgeting.

Investment requirements through 2000 are estimated to total $9,285 million. Approximately two-thrids of the total are needed for city or county maintained roads and bridges. The estimate includes $602 million for interstate completion, $371 million for other new construction of major roads, $175 million for highway safety improvements, $927 million for grade separations or at-grade protection devices and $882 million for repair, resurfacing or reconstruction of state-maintained roads. It also includes $2,335 million for repair and resurfacing of city and county maintained roads and $2,109 million for new city streets. An additional $546 million is required to meet backlogged bridge repair and replacement needs on all systems.

It is likely that some $7–8 billion will be available to meet these needs. This figure is based on a five-year projection of revenues extrapolated to the longer planning time frame of this study.

2. *Railroads.* Increased shipments of coal has created conflict between vehicular and rail traffic. Grade separations (included in the highway section) will ease problems. But, in addition, the state wants to undertake the Sterling-Rock project that would include relocation and upgrading of railroad lines to bypass the Denver metro area.

3. *Mass transit.* There are five major public transportation systems operating in Denver-Boulder, Colorado Springs, Pueblo, Fort Collins and Greeley and smaller bus systems operating in Aspen, Vail and Steamboat Springs. About 92 percent of all passenger trips are made on the RTD system serving Denver and Boulder.

Capital investment needs are projected at $2,254 million, with $1,924 million of that for a light rail system planned for Denver. The major need of most systems is for continued operating subsidy rather than capital investment.

Revenues are estimated at $540 million. This does not include any new sales tax, which the RTD assumes would be levied to finance the light rail system.

4. *Airports.* The hub of Colorado's air transport system is Denver's Stapleton Airport, which handles 90 percent of all emplanements in Colorado. There are 106 other public airports, 16 of which receive scheduled commercial service.

The major public capital investment need is for expansion of Stapleton or construction of a new Denver regional airport. An investment of $1.2 billion is estimated assuming the expansion option is followed. An additional $302 million in needs is projected for other airfields based on a dated (1973) state plan.

Revenues were projected at $1,516 million through 2000. This projection assumed a declining federal role over the period, with the remainder of revenues derived locally. The state plays no role in financing air transportation.

B. Water Supply, Storage, Treatment and Distribution

Colorado is a semi-arid state where evaporation on the whole exceeds precipitation. Precipitation is variable by area, by season and cycles of wet and dry years. Because of this cyclical and seasonal variability, reservoirs are needed to capture high spring flows for release later in the year and to store water from year to year. Extensive transportation distribution systems are also required with some water being carried across the Continental Divide.

The amount of water available for consumption in Colorado is limited by interstate compact, Supreme Court decision and international treaty. While Colorado is not now using its full allotment, there is concern that overall flows in the Colorado River fall short of the total amount allotted among states and that the last states to claim their allotments may lose their water rights.

East of the Continental Divide, surface water supplies are fully utilized and the Ogallala Aquifer is being pumped at rates which will probably deplete it over the next 25 to 50 years.

It is Colorado's policy to capture all the water to which it is legally entitled, and investment needs are defined by the fiscal limits within which this policy can be practiced. As noted previously, the state fears that if it fails to use its water, it may lose it to lower basin states. Then the only way to meet growing-related increases in demand for municipal and industrial purposes would be a reallocation of water from agriculture to these purposes. Such a reallocation is viewed as undesirable.

Colorado estimates that approximately $1.2 billion will be needed in the next five years for agricultural water supply projects. To capture all water to which the state is entitled might cost an additional $3.6 billion.

The Blue Ribbon Panel found that existing raw water supply, treatment and distribution systems could accomplish expected municipal growth through 1986, but beyond that some expansions of facilities would be required. There is an immediate need to improve rural domestic water supply systems to meet water quality standards. The total estimated investment requirement is $790 million.

The projection of revenues for agricultural water systems is $958 million, $289 million less than the level of investment required. Assuming some level of state assistance, revenues available for municipal water systems are projected to be $1056 million.

C. Sewage Treatment Systems

Additional treatment capacity and sewer lines will be needed to handle expected growth in the existing urban areas along the Front Range and in areas where the state's energy, mineral and recreational resources will be developed. In addition, many communities will have to upgrade treatment systems to meet discharge standards. It is projected that $1,228 million will be required to meet these needs. Revenues are projected to total $657 million leaving a gap of $571 million through 2000.

III. SUMMARY AND CONCLUSIONS

In order to meet its needs in the transportation, water and sewer functions, Colorado governments will have to invest nearly $17 billion over the next 18 years. Transportation accounts for over 80 percent of projected needs. The biggest financing gap occurs in the other transportation category, as some kind of revenue base must be found to finance a new light rail system in the Denver metropolitan area. New revenue sources will also have to be found to meet wastewater treatment needs; projected revenues cover only 54 percent of anticipated needs.

SUMMARY OF CAPITAL INVESTMENT NEEDS AND REVENUES

[In millions of 1982 dollars]

	Needs	Revenues	Gap
Highways and bridges	9,285	7,992	1,293
Other transportation	4,450	2,050	2,400
Water systems	2,020	2,020	0
Sewage treatment	1,230	660	570
Total	16,985	12,772	4,263

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF COLORADO

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$97	$9	$31	$136	$244	$274	$280	$27	$89	$397	$679	$769
1970	105	7	23	135	253	277	276	19	64	360	653	717
1971	145	10	17	172	315	332	350	26	43	419	752	794
1972	161	17	39	217	351	389	372	41	92	504	790	882
1973	141	10	61	213	364	425	307	22	136	465	769	905
1974	132	29	58	219	422	480	224	55	112	390	757	868
1975	169	41	68	278	571	639	267	69	111	447	940	1,051
1976	204	49	60	314	665	726	325	78	93	496	1,063	1,156
1977	196	49	75	321	613	688	301	74	111	486	926	1,037
1978	199	52	86	337	582	668	256	70	115	442	786	901
1979	209	65	121	396	683	805	227	79	148	453	812	959
1980	252	58	224	534	681	905	238	65	249	552	726	975
1981	233	57	195	485	732	927	222	60	202	484	744	946

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	2,142	130.71	12.79	41.76	185.26	317.10	358.87	0.36	0.04	0.12	0.52	1.00
1970	2,210	124.93	8.81	28.98	162.73	295.37	324.34	.39	.03	.09	.50	1.00
1971	2,278	153.54	11.60	18.84	183.98	329.94	348.78	.44	.03	.05	.53	1.00
1972	2,346	158.42	17.27	39.27	214.96	336.88	376.15	.42	.05	.10	.57	1.00
1973	2,414	127.17	9.26	56.33	192.76	318.43	374.77	.34	.02	.15	.51	1.00
1974	2,482	90.10	22.04	44.97	157.12	304.96	349.93	.26	.06	.13	.45	1.00
1975	2,550	104.68	26.99	43.52	175.19	368.54	412.07	.25	.07	.11	.43	1.00
1976	2,617	124.10	29.91	35.54	189.55	406.27	441.81	.28	.07	.08	.43	1.00
1977	2,685	111.97	27.52	41.35	180.84	344.81	386.16	.29	.07	.11	.47	1.00
1978	2,753	93.00	25.56	41.88	160.43	285.48	327.36	.28	.03	.13	.49	1.00
1979	2,821	80.30	27.85	52.39	160.54	287.71	340.10	.24	.08	.15	.47	1.00
1980	2,889	82.52	22.46	86.22	191.21	251.30	337.52	.24	.07	.26	.57	1.00
1981	2,957	75.13	20.36	68.25	163.75	251.54	319.79	.23	.06	.21	.51	1.00

FLORIDA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

Florida is one of the rapidly growing Sunbelt states. Florida and its local governments face two difficulties. First, they have not kept pace with the maintenance of public facilities, particularly highways. Second, due to rapid population increases, there is a large backlog of needed new construction.

Population. The population growth rate of Florida can be placed in perspective by noting that:

Between 1970 and 1980, the state's population increased by more than 43 percent.

By 1990, Florida will have more than 12 million residents, ranking it fourth among the states.

It is projected that during the 1980s, Florida will grow at a rate twice that of other Sunbelt states and more than three times the rate of the U.S. as a whole.

The capital planning process. Florida can expect its infrastructure difficulties to become worse as federal revenues decline. In 1980, federal revenues comprised 24 percent of total state revenues and 10 percent of total local revenues. Federal aid to the state and local governments has grown at an annual rate of 13.3 percent and 23.2 percent respectively during the 1960 to 1980 period. This trend has made both units of government increasingly dependent on these federal funds.

Even recognizing the historical dependence on federal funds, Florida has considerable fiscal capacity.

Florida ranked 43rd among all states in fiscal year 1980–81 in the relationship of state taxes to personal income.

Florida ranked 35th in terms of per capita tax revenues.

Florida ranked 50th in the increase of the state-local tax burdens between 1953 and 1975.

In the aggregate, local governments in the state have substantial unused property tax capacity, but it is not evenly distributed among all local governments.

Even recognizing this capacity and the relatively moderate tax burden being placed on Florida residents, there are caveats related to using this capacity. The first is the voter's reluctance to approve any tax increases. In fact, a "Proposition 13" type amendment is being placed on Florida's November 1984 ballot. The second caveat is that many local governments have chosen to not construct new capital facilities in an effort to divert growth to other areas. The policy has largely failed.

Florida is aware of the growing infrastructure requirements and the declining federal resources available to meet those needs. During this past legislative session—

An additional penny was added to the state sales tax;

Changes were made to the state gas tax;

Counties were given the authority to add up to four additional cents on the state gas tax; and

An additional $100 million was provided to help local governments meet their wastewater facility needs.

II. HISTORICAL CAPITAL INVESTMENT

Historical state and local government capital expenditures for highways, water and wastewater have increased from $909 million in 1977 to $1,389 million in 1981. Per capita capital expenditures expressed in real terms have nevertheless declined.

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[1] Based on Neil G. Sipe and Earl M. Starnes, "Florida's Infrastructure Needs and Resources, 1982–2000: A Preliminary Analysis," (Bureau of Economic and Business Research, University of Florida: September 1983).

PER CAPITA STATE AND LOCAL GOVERNMENT CAPITAL EXPENDITURES, 1975 TO 1981

[1972 dollars]

Year	Highways	Water	Wastewater
1975	$54.93	$5.71	$12.49
1976	42.35	9.88	23.07
1977	35.14	9.85	25.13
1978	36.63	8.58	15.56
1979	41.61	7.00	16.75
1980	47.62	13.50	13.77
1981	41.68	15.81	13.05

Per capita real expenditures totaled $73 in 1975, increased to $75 per capita in 1976, declined to $61 per capita in 1978, and were nearly $71 per capita in 1981. While highway expenditures declined the most over the 1975 to 1981 period, real per capita expenditures—with the exception of 1975—have been relatively stable. Water expenditures nearly tripled over the 1975 to 1981 period, while wastewater expenditures, which were quite heavy in 1976 and 1977, increased only slightly. Of the three categories, highway expenditures remains dominant, accounting for 59 percent of the 1981 per capita capital expenditures.

III. FUNCTIONAL DESCRIPTIONS

The approach taken in Florida was to focus on both new and future infrastructure needs and existing or backlogged needs. The projection of future needs is highly dependent upon assumptions about population growth. A medium growth scenario was used in this analysis which forecasts 2000 population to be 14.6 million. In the costs shown below, the costs of debt is not included.

A. Transportation

Transportation components addressed in the Florida study included highways, bridges, railroads, mass transit, and air and water ports.

1. *Highways and bridges.* The highway system im Florida, including state highways, interstate highways, county roads, and city streets, consists of 95,776 miles. The state highway system is comprised of 9,867, or about 10 percent of the total, but carries more than 58 percent of the annual vehicle miles traveled in the state. The interstate highway system presently totals 1,258 miles and will total 1,460 miles when completed within the next ten yers at a cost of $2.3 billion.

There are more than 9,000 bridges in Florida of which 5,087 are state maintained. The Seven Mile Bridge in the Florida Keys has recently been reconstructed a cost of $189 million and is now the longest precast-segment bridge in the world. The Sunshine Skyway Bridge, after being severely damaged in 1980, is scheduled to be reconstructed by 1985 at a cost of more than $230 million.

The Florida Department of Transportation (FDOT) assessed the condition of the state's roads in 1981. It found that 23 percent of the state highways were structurally deficient and 19 percent were operationally deficient. Bridges were categorized as either requiring replacement or needing repair. A total of 278 bridges require replacement, and 1,145 bridges require immediate repair.

The cost estimates for state and federal road and bridge needs were compiled by the FDOT. These costs included five categories: resurfacing, new construction, bridge replacement, and traffic operations (e.g., highway lighting, intersection improvements). Total highway needs are $11.6 billion in 1982 dollars, or $14.9 billion with current backlog requirements included.

Based on 1979 data, more than 35 percent of the revenues for the state's transportation system come from the motor fuel tax. The federal government provides almost 30 percent of the revenue, and slightly more than 22 percent comes from cities and counties with the balance of 12 percent coming from bond issues. Total funding through 2000 is projected to be $7.3 billion which results in a revenue gap of $7.6 billion including the backlog.

2. *Public transportation.* This category includes transit, rail, aviation and seaports. Florida has a rail system comprised of 3,700 miles of track owned by 12 railroad companies, 484 licensed landing facilities including one blimp base, 10 major ports and 17 minor ports, and 24 urban transit systems, operating about 1,500 buses. Total needs and anticipated resources for these categories are listed in the following table.

FLORIDA'S 1982–2000 PUBLIC TRANSPORTATION NEEDS AND RESOURCES

[In millions of 1982 dollars]

Category	Estimate
Needs:	
Transit	818
Rail	269
Aviation	262
Seaports	96
Total Needs	1,445
Resources	825
Unmet Needs	620

B. Water Supply, Distribution and Treatment

The largest use of fresh water in the state is for irrigation which consumes 62 percent of the total. Public withdrawals amount to only 329 millions of gallons per day or less than 14 percent of the state total. Eighty-seven percent of the water used for public supplies comes from groundwater.

Population concentrations and water supplies do not coincide. The Floridan aquifer underlies the state, and is estimated to contain more water than all the Great Lakes. The aquifer is potable, but located away from population centers.

The methodology used to estimate needs was based on a per capita rate of consumption of 125 gallons and the medium population projections with an adjustment for a small share of the new population which would not connect to a central water system. These estimates assume no backlog requirements. Based on the analysis, projected costs are $228 million for treatment and $1,025 million for transmission, or $1.3 billion total for the 1982 to 2000 period.

Revenues are a function of local user charges and are projected to range from $0 to $.3 billion over the 1982 to 2000 period.

C. Wastewater Collection and Treatment.

There are 3,700 permitted domestic wastewater treatment facilities in Florida. There are 186 plants which treat more than one million gallons per day; these plants provide more than 82 percent of the treatment in the state. There is no accurate count on the number or location of septic tanks statewide although these represent a problem area for once rural areas which are facing rapid urbanization.

The methodology for estimating the state's wastewater collection and needed needs utilized a per capita sewage-generation rate of 100 gallons per day combined with the medium scenario population projections and an allowance for some wastewater that does not receive treatment. The estimates do not take into account the backlog of treatment needs estimated by EPA to be $2.1 billion in 1980 dollars. The total needs are calculated to be $609 million for treatment needs and $979 million for collection needs, or a total cost of $1.6 billion for the 1982 to 2000 period.

Revenues will reflect the share of federal participation in local projects as well as anticipated connection charges and impact fees. Total revenues could be sufficient to meet the projected needs depending on the level of local charges and the role of the federal government. Revenues are projected to range from $873 million to $1,588 million (the latter estimate equating with the projected needs).

IV. SUMMARY AND CONCLUSIONS

The total capital needs projected for the State of Florida for transportation, water, and wastewater over the 1982 to 2000 period total $28.0 billion.

SUMMARY OF FLORIDA'S 1982–2000 INFRASTRUCTURE NEEDS AND RESOURCES

[Millions of 1982 dollars]

Infrastructure	Needs	Resources	Shortfall
Transportation	25,192	17,250	7,942
Water	1,254	0–1,254	0–1,254
Wastewater	1,588	873–1,588	0–615
Total	28,034	18,123–20,091	7,942–9,811

If existing backlog requirements are included, the total needs estimate increases to $33.4 billion, or an annual expenditure of $1.857 billion per year. Transportation needs dominate accounting for 90 percent of the total 1982 to 2000 needs.

Revenue sources appear to be insufficient to meet these needs as shown above. Only 65 to 72 percent of the identified needs will be met given the projections of revenue.

How valid are the projections presented? One approach for testing the reasonableness of the estimates is to compare the annual projected capital expenditures with those of 1981. In 1981, Florida spent $1.39 billion on the infrastructure items of prime interest here. The expenditures projected over the 1982 to 2000 period (not including the backlog requirements) amount to $28.03 billion, or $1.56 billion per year. The difference of roughly $170 million suggests the order of magnitude of these estimates is reasonable.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF FLORIDA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$221	$30	$39	$290	$651	$690	$638	$95	$114	$848	$1,813	$1,927
1970	266	46	31	343	728	759	699	134	85	918	1,876	1,961
1971	388	42	33	463	972	1,005	934	110	83	1,128	2,318	2,401
1972	434	40	25	499	1,037	1,062	1,004	94	59	1,157	2,338	2,397
1973	447	47	38	531	1,046	1,084	969	103	84	1,157	2,213	2,297
1974	504	63	59	626	1,215	1,274	854	120	114	1,087	2,180	2,294
1975	592	135	62	788	1,715	1,776	933	227	100	1,261	2,821	2,921
1976	501	273	117	891	1,647	1,764	797	434	180	1,412	2,633	2,813
1977	456	326	128	909	1,772	1,900	698	487	188	1,374	2,678	2,866
1978	519	220	121	860	1,684	1,805	669	300	162	1,131	2,274	2,436
1979	649	261	109	1,019	2,025	2,134	702	317	133	1,152	2,406	2,539
1980	832	241	236	1,309	2,208	2,444	787	270	263	1,319	2,354	2,617
1981	821	257	311	1,389	2,457	2,768	783	271	322	1,376	2,497	2,819

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	6,496	98.27	14.69	17.51	130.46	279.13	296.63	0.33	0.05	0.06	0.44	1.00
1970	6,791	103.00	19.69	12.48	135.17	276.26	288.74	.36	.07	.04	.47	1.00
1971	7,086	131.82	15.58	11.75	159.15	327.08	338.84	.39	.05	.03	.47	1.00
1972	7,381	136.03	12.73	7.94	156.71	316.78	324.72	.42	.04	.02	.48	1.00
1973	7,676	126.30	13.39	11.01	150.69	288.25	299.26	.42	.04	.04	.50	1.00
1974	7,971	107.11	15.01	14.29	136.41	273.54	287.83	.37	.05	.05	.47	1.00
1975	8,266	112.92	27.51	12.12	152.55	341.27	353.40	.32	.08	.03	.43	1.00
1976	8,560	93.12	50.73	21.05	164.90	307.56	328.61	.28	.15	.06	.50	1.00
1977	8,855	78.83	55.03	21.26	155.12	302.37	323.64	.24	.17	.07	.48	1.00
1978	9,150	73.09	32.82	17.70	123.61	248.53	266.24	.27	.12	.07	.46	1.00
1979	9,445	74.30	33.59	14.08	121.96	254.72	268.79	.28	.12	.05	.45	1.00
1980	9,740	80.81	27.69	26.97	135.47	241.69	268.65	.30	.10	.10	.50	1.00
1981	10,035	78.03	26.96	32.10	137.09	248.82	280.92	.28	.10	.11	.49	1.00

INDIANA[1]

Profile of State Infrastructure Requirements

I. CONTEXT

Indiana is the 12th most populous state in the union with approximately 5.5 million persons. It is relatively urban with metropolitan areas comprising 69.8 percent of the population. Heavily dependent on the auto and steel making industries, the state has experienced higher unemployment rates than the nation as a whole. Diversifying the state's economy will require substantial investments in the state's infrastructure before major structural changes can be implemented.

Population and economic context. The context in which infrastructure issues are being addressed includes:

Population growth—in the last decade, the population growth rate in Indiana has been almost half of the national average. During 1980–82 there was a net outmigration of 107,000 people and a population loss of 20,000.

Economic base—Indiana is a major industrial and agricultural state. It ranks ninth in the nation in terms of value added by manufacture and eighth in terms of cash receipts from its farm produce. The manufacturing sector generates 40 percent of salaries and wages in the state as compared with 26 percent for the nation as a whole.

Income—Indiana is very vulnerable during recessionary periods. It is commonly feared that many of the jobs lost during the current recession may never be replaced. Located in the "forest-belt," there is also the fear that Indiana will be at a disadvantage as many industries relocate in the "sun-belt."

Tax burden—Some Hoosiers boast of being the least taxed people in the U.S. The low levels of taxes may or may not provide incentives for new industries to locate in Indiana, but they do ensure difficulties for the services and infrastructure provided by the state.

Infrastructure planning. In areas where the local role is predominant, the lack of data for compiling into a state-wide planning process is apparent. In areas where the state role is large (e.g. highways) there seems to be a better availability of aggregate statewide data and a greater appreciation of the need to develop long range "needs" estimates. Most of the state government agencies seem to be technically oriented and confronted with large backlogs of projects. The result is that a need for projecting beyond a few years is not felt. There seems to be an aversion for a centralized planning system.

II. FUNCTIONAL DESCRIPTIONS

Investment needs for transportation, water supply and wastewater treatment have been addressed. Funding requirements and sources of revenues have also been studied, but only on a general basis.

A. Transportation

Historically Indiana has made a substantial investment in the state's infrastructure, which has provided Indiana with one of the most efficient transportation systems in the nation. Transportation components addressed in the Indiana study included highways, airports, and public transit.

1. *Highways.* In 1981, Indiana had a total of 91,469 miles of highways, roads and streets. Of these, 11,148 were part of the state highway system, 66,412 were part of the county highway system, 13,752 belonged to the city street system and 157 miles were toll roads. Breaking the capital and maintenance requirements for all of the highways, roads and streets within the state into real, intermediate and minimum need requirements, the following projections were derived for a planning period from 1982 to 2000:

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[1] Based on Salmon Shah and Morton J. Marcus, "Indiana's Infrastructure Requirements 1982–2000," Division of Research, School of Business, Indiana University, September 1983.

INDIANA'S HIGHWAY NEEDS

[In millions of 1982 dollars]

	Real	Intermediate	Minimum
Total requirement 1982–2000	38,982.9	31,599.5	26,049.4
Yearly average requirement	2,051.7	1,663.1	1,371.0

These figures include estimates for bridge replacement and maintenance repair on state, county and city roads.

Minimum needs are assessed using several criteria, including:

Correcting unsafe conditions,

Restoration and preservation of the existing road network,

Repair and/or replacement of all deficient bridges,

Accommodation of increased traffic volumes to ensure that the percentage of capacity deficient mileage does not increase inordinately, and

Improvement of local access facilities to ensure passability at all times of the year.

Real needs are based on improvements needed to ensure the adequacy of roads for traffic volumes projected for 1995.

Projected revenues available for meeting these needs range from $918 million in 1982 to $1,466 million in 2000. These projections come from a regression analysis of the traditional funding sources—federal grants, state user taxes, property and miscellaneous taxes, and general fund appropriations.

2. *Airports.* Of Indiana's 550 airports, 414 (including 36 heliports) are privately owned and not open to the public. The remaining 130 airports and 6 heliports are open to the public and of these, 61 are publicly owned. Six of the state's cities are served by certified air carriers. In addition, seven other cities receive scheduled service. The Indiana State Airport System Plan developed estimated needs for airport development in Indiana from 1981 to 2000. The estimated total costs for capital improvements recommended in the plan amount to $864 million. Operations and maintenance expenses up to 2000 are estimated to amount to $218 million.

Over the same 1982 to 2000 period, revenues are estimated to total $237 million, basically enough to cover operating and maintenance expenses. This leaves a projected deficit of approximately $850 million. Of this amount, approximately $617 million worth of projects would be eligible for federal funding. The remaining would be funded from state and private source.

3. *Public transit.* Approximately 3 million people, out of a state population of 5.5 million, are served by the 17 publicly owned transit systems and one commuter railroad which existed in Indiana as of 1980. In 1980, these public facilities carried nearly 37 million passengers. The 588 vehicles in the system's bus fleet had an average age of just over eight years in 1980. Since 1977, the gap between operating expenses and revenues has been widening primarily due to higher labor, fuel and maintenance costs. While revenues covered 49.8 percent of operating expenses in 1976, they only covered 33.2 percent of expenses in 1980.

There has not been a recent study which assesses the capital investment needs of public transportation until 2000. A study assessing the needs from 1981 to 1985, however, estimated that a total capital expenditure of $239 million would be necessary over the five year period, or an average annual expenditure of $48 million. These figures are substantially more than federal, local, and state government capital cost assistance in recent years. Considering the average age of the fleet is about eight years, it can safely be assumed that major capital expenditures would have to be made in the early '90's when the fleet would have to be replaced. Indiana's only railway, which runs from downtown Chicago to South Bend, will require an estimated $135 million per year for capital and operating expenses. This amounts to $2.56 billion for the 1982–2000 period. Operating revenues for this same period will amount to $524 million, or $27.6 million per year.

B. Water Supply, Distribution and Treatment

Indiana is blessed with an abundant water supply. The role of the state government in supplying water is limited since the responsibility of water supply is a local matter. A recent report by the governor's water resource study commission projected that withdrawal of water for public supply is expected to increase by 31 percent by 2000 (from 1980 levels). However, the amount of funds required to meet these projections, or the state's share, was not quantified in the report.

C. Wastewater Collection and Treatment

The state and federal governments are heavily involved in the funding of facilities for wastewater treatment. Surveys conducted by the Environmental Protection Agency, however, are the only source of information for future capital requirements for wastewater treatment in the state. Approximately $9 billion will be necessary to meet the capital needs identified by the EPA from 1980 to 2000. A major portion of this amount would qualify for EPA funding. It is assumed that the revenues available through user's fees would be enough to cover the operation expenses of these facilities.

III. SUMMARY AND CONCLUSIONS

Because the methods of reporting funding needs for the different areas showed substantial variance, it is difficult to summarize, in a consistent manner, Indiana's capital investment needs over the planning period 1980–2000. Each category is summarized separately below:

Total highway investment needs for the period from 1982 to 2000 range from a "minimum" amount of $26 billion to a "real" amount of $39 billion. Minimum and real annual funding estimates are $1.4 billion and $2.1 billion, respectively. Periodic funding deficits are probable.

Approximately $864 million is required for airport development between 1981 and 2000. About three-fourths of this amount qualifies for federal funding.

Total capital investment needs for public transit facilities for the 1980–2000 planning period are unknown. Indiana's bus systems alone will require an estimated $239 million for the five year period ending in 1985. Projections beyond 1985 have not been quantified. The state's rail system, one line, will require $2.56 billion between 1982 and 2000. However, this figure includes operation and maintenance, as well as capital expenditures. Operating revenues are projected to cover approximately one-fifth of this amount.

No estimates have been formulated as to the total capital cost of meeting the state's projected water needs by the year 2000. It is estimated that public water use in 2000, however, will be 31 percent greater than 1980 levels.

Renovating and constructing new wastewater treatment facilities is expected to cost more than $9 billion between 1981 and 2000. User fees will not be available for capital cost as they will just be sufficient to cover operating and maintenance costs.

The table below summarizes capital outlay requirements and anticipated revenues by category through 2000.

SUMMARY REQUIREMENTS IN THE YEAR 2000

[In millions of 1982 dollars]

	Requirements	Funds availability	Gap
Highways	38,983	22,907	16,076
Airports	1,083	237	846
Public transport	2,560	524	2,036
Water supply, treatment and distribution	(1)	(1)	(1)
Waste water treatment	9,300	(1)	9,300
Total	51,926	23,668	28,258

[1] Unknown.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF INDIANA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government and water	Highways	Sewerage	Water	Subtotal	All government no water	All government and water
1969	$237	$46	$18	$301	$596	$613	$686	$144	$52	$882	$1,659	$1,711
1970	203	36	22	261	615	637	534	104	60	699	1,584	1,644
1971	232	40	8	280	634	642	559	105	21	685	1,512	1,533
1972	271	47	10	328	729	739	627	111	24	762	1,643	1,666
1973	239	38	11	287	615	626	520	82	23	625	1,301	1,324
1974	240	41	10	291	591	601	407	78	19	504	1,060	1,079
1975	302	80	9	391	758	768	476	135	15	627	1,248	1,263
1976	364	48	11	424	794	805	580	77	17	674	1,269	1,286
1977	290	61	7	358	759	766	445	92	10	547	1,146	1,156
1978	248	58	12	318	680	691	320	80	15	415	918	933
1979	326	80	27	432	779	805	352	97	32	482	925	958
1980	411	106	27	544	1042	1069	389	119	30	538	1,111	1,141
1981	380	166	24	569	1182	1206	362	174	25	561	1,201	1,226

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government and water	Highways	Sewerage	Water	Subtotal	All government and water
1969	5,166	132.77	27.92	10.02	170.70	321.25	331.27	0.40	0.08	0.03	0.52	1
1970	5,195	102.85	20.09	11.58	134.53	304.95	316.54	.32	.06	.04	.42	1
1971	5,225	107.04	20.08	3.94	131.06	289.49	293.43	.36	.07	.01	.45	1
1972	5,254	119.31	21.16	4.47	144.94	312.66	317.13	.38	.07	.01	.46	1
1973	5,284	98.36	15.55	4.43	118.34	246.16	250.59	.39	.06	.02	.47	1
1974	5,313	76.55	14.62	3.61	94.78	199.52	203.13	.38	.07	.02	.47	1
1975	5,343	89.14	25.35	2.84	117.32	233.55	236.39	.38	.11	.01	.50	1
1976	5,372	107.93	14.31	3.19	125.42	236.19	239.37	.45	.06	.01	.52	1
1977	5,402	82.30	17.01	1.88	101.19	212.20	214.08	.38	.08	.01	.47	1
1978	5,431	58.90	14.64	2.85	76.39	168.99	171.84	.34	.09	.02	.44	1
1979	5,461	64.49	17.82	5.91	88.21	169.44	175.35	.37	.10	.03	.50	1
1980	5,490	70.86	21.64	5.42	97.92	202.39	207.80	.34	.10	.03	.47	1
1981	5,520	65.65	31.57	4.46	101.68	217.68	222.14	.30	.14	.02	.46	1

KENTUCKY [1]

Profile of State Infrastructure Requirements

I. CONTEXT

Kentucky's population is expected to increase by 30 percent by 2000. Most of this growth will be in rural areas of the state. To meet acceptable standards, this growth will require substantial investment in water and sewerage treatment facilities. In addition, the state's agricultural and coal mining sectors will require an improved transportation system.

Economic development financing has become a major thrust in Kentucky's infractructure investment effort. In 1982, the Brown Administration sought and the legislature authorized the issuance of $100 million in bonds designed to assist the private sector in developing a strong, diversified economic development program. This program emphasizes the construction of industrial parks and the development of riverport, downtown and recreational facilities.

The ability to finance basic public infrastructure is becoming a major challenge to most states. Kentucky is currently pursuing a variety of capital planning initiatives to deal with emerging investment needs. These initiatives are coordinated through a Strategic Planning and Program Analysis (SPPA) process which will result in the commonwealth having a five-year capital plan for the first time. Creation of a capital planning process obviously should include an assessment of the future infrastructure needs of the commonwealth.

II. FUNCTIONAL DESCRIPTION

The Kentucky case study examined transportation, water and wastewater requirements as well as water resources (i.e., dams, flood control).

A. Transportation

The major transportation component is highways and bridges.

1. *Highways and bridges.* The provision of public roads in Kentucky has been a responsibility of state government since 1779, when legislation was passed by the General Assembly empowering Joseph Crockett to erect a turnpike on the road leading from Crab Orchard to Cumberland Gap. In 1974, the Kentucky Department of Transportation was established. In 1982, legislature established the Transportation Cabinet which took on the responsibilities of the Department of Transportation.

Currently, the Transportation Cabinet is responsible for the construction, reconstruction and maintenance of the commonwealth's primary road system which consists of approximately 25,260 miles and approximately 8,500 bridges.

A rather unusual element of Kentucky's transportation system is the Kentucky Turnpike Authority. Created in 1960 by the General Assembly, the authority constitutes a dejure municipal corporation and political subdivision of the commonwealth. Under a lease back arrangement with the Transportation Cabinet, the authority is empowered to construct and finance, through the issuance of revenue bonds, toll road projects, resource recovery road projects and proposed economic development road projects. As of March 31, 1983, the authority had $740,939,000 of revenue bonds outstanding. The 1980 Kentucky General Assembly, acting on a finding that highways and roads vital to the economic development of Kentucky were deteriorating, amended the 1960 legislation and empowered the authority to issue $300 million of revenue bonds to construct or reconstruct roads which enhance economic development in the commonwealth.

Kentucky derives revenues for highway and bridge construction, reconstruction and maintenance from major sources: federal aid, turnpike authority, and the State Road Fund. Like most other states, Kentucky levies usage taxes to provide revenue for its highway system. The predominate user charge is a motor fuels tax. Of the total revenues received on this excise tax, 44.5 percent is allocated as revenue sharing to county and local governments for construction and maintenance of rural and urban roads. Other major sources of tax revenue which constitute the State Road Fund include the motor vehicle registration tax, operator's license revenue, weight distance tax and the motor vehicle usage tax.

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[1] Based on Phillip W. Roeder and Dennis B. Murphy, "Kentucky's Public Infrastructure Needs: Capital Investment Planning and Budgeting," (Bureau of Policy Research, Martin Center for Public Administration, University of Kentucky: October 1983)

From fiscal year 1975 through the third quarter of 1983, Kentucky had spent $2,911 million on the construction of federally aided and non-federally aided highways and bridges. Assuming a continuation of this trend would suggest total revenue for highways and bridges of nearly $6.0 billion from 1983 to 2000. For purposes of analysis, a figure of $20.4 billion is used.

Investment needs through the year 1989 are projected to be $13,620 million in 1982 dollars for Kentucky's highways and bridges excluding Kentucky's city and county roads. The authors considered projections beyond 1989 to be too tenuous given data availability and reliability. Extrapolating this trend suggests a total capital outlay for highways and bridges of $35 billion through 2000.

2. *Mass transportation.* There are 17 bus mass transit systems operating in Kentucky. Local conditions dictate the existence and level of service. Capital outlays averaged $13.1 million over the past five years with the vast majority of these expenditures coming from federal sources, notably UMTA grants. Investment needs in Kentucky are not great due to the predominantly rural population. Through 1989, the authors project a capital outlay requirement of $52 million.

3. *Airports.* There are 62 publicly owned airports in Kentucky. Of these, seven have regularly scheduled daily passenger and fright service. From fiscal 1979 through 1983, $26.7 million was spent on airport development projects although federal and state expenditures have steadily declined over this period. Through 1989, projected needs are estimated to be $55 million.

4. Railroads. Currently there are 10 Class I carriers operating over 3,450 miles of track in Kentucky. Due to the potential damage to the state's economy, the state will acquire and rehabilitate about 100 miles of track at a cost of $7 million between now and 1989.

B. Water Supply, Distribution and Treatment

There are presently 1,081 public water systems operating in Kentucky; however, only 233 are regulated by the state Public Service Commission. In addition, approximately one-third of Kentucky's rural population relies on private wells for domestic waters.

With no central planning agency for water supply, data limitations constrain the ability to project investment needs. However, a straight forward approach for projecting capital needs is to rely on past expenditure patterns and projected population levels. This approach yields a projection of needs totaling $1,428 million from 1983 to 2000 for water supply, treatment and distribution.

This approach, however, fails to include backlogged requirements. On the other hand, it may overestimate needs, since some systems have excess capacity and can accommodate future growth.

C. Wastewater Collection and Treatment

There are 541 wastewater treatment facilities operating in Kentucky; 257 are publicly-owned municipal systems. The remaining 284 systems are privately-owned systems regulated by the Public Service Commission. As in the case of water supply, no central agency exists to coordinate facilities needs and information.

The EPA 1982 Needs Survey assessed backlogged needs and year 2000 needs by category. For Kentucky, total needs by 2000 are estimated to be $3,070 million.

Between 1975 and 1982, Kentucky spent $650.8 million on wastewater facilities of which $420.5 million was in the form of EPA construction grants. For later analysis of future revenue, this level of funding has been assumed. Although, as noted by the case study authors, the 1981 Construction Grant Amendments will substantially alter the level of future federal participation in grant awards; specifically, the federal share will be lowered from 75 percent to 55 percent. Thus, local governments' share will rise from 25 percent to 45 percent.

Historically, Kentucky has played a small role in financing publicly-owned wastewater treatment facilities. A form of state assistance exists in the Kentucky Pollution Abatement Authority. The authority assists local governments in financing facilities by issuing tax-exempt bonds in the authority's name and, subsequently, loaning the proceeds to local entities. At present, the state is also considering a state match program to provide 10 percent of the additional 20 percent which local governments must finance under the 1981 amendments.

III. SUMMARY AND CONCLUSIONS

A summary of study findings is provided below. Capital investment needs have been projected to the year 2000 for water supply, treatment, and distribution and for wastewater treatment. Transportation needs are limited to an estimate to 1989.

SUMMARY OF FINDINGS

[In millions of 1982 dollars]

	Fiscal year 1989 needs	2000 needs
I. Transportation:		
A. Highways and bridges	13,620	(1)
B. Local streets and roads	(1)	(1)
C. Mass transit	52	(1)
D. Airports	55	(1)
E. Railroads	7	(1)
II. Water supply, treatment, and distribution	672	1,428
IV. Wastewater treatment	859	3,070

(1) Unknown.

For comparative purposes, transportation projections have been assumed to be uniform over the 1983 to 1989 period, and this trend has been extrapolated to yield a projection through 2000 as follows:

NEEDS AND REVENUES FOR KENTUCKY, 1983 TO 2000

[In millions of 1982 dollars]

	Needs	Revenues
Highways and bridges	20,430	8,550
Other transportation	293	286
Water supply, treatment, and distribution	1,428	1,349
Wastewater treatment	3,070	1,464

Revenues to the year 2000 are based upon the simplifying assumption that recent expenditure patterns would remain constant through the end of the century.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF KENTUCKY

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$250	$11	$15	$276	$493	$509	$724	$33	$45	$803	$1,374	$1,419
1970	212	11	13	236	462	474	556	33	35	624	1,189	1,224
1971	257	12	14	284	467	481	620	31	37	688	1,113	1,150
1972	307	14	21	341	488	508	710	32	49	790	1,100	1,148
1973	298	27	20	345	521	542	648	58	45	751	1,102	1,148
1974	252	41	32	325	499	531	428	77	61	566	895	957
1975	280	43	38	362	594	632	442	73	63	578	977	1,039
1976	310	56	31	396	689	720	493	88	48	629	1,101	1,149
1977	295	28	38	362	673	711	453	42	56	551	1,016	1,072
1978	384	48	20	452	724	744	495	66	27	588	977	1,004
1979	598	92	29	719	1,099	1,128	647	111	35	794	1,306	1,341
1980	742	63	27	831	1,215	1,242	702	70	30	802	1,295	1,325
1981	626	44	42	712	1,033	1,075	597	46	44	687	1,049	1,093

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,177	227.98	10.50	14.17	252.65	432.61	446.78	0.51	0.02	0.03	0.57	1.00
1970	3,221	172.66	10.29	10.88	193.84	369.17	380.05	.45	.03	.03	.51	1.00
1971	3,265	189.95	9.62	11.20	210.77	340.94	352.14	.54	.03	.03	.60	1.00
1972	3,309	214.55	9.61	14.71	238.86	332.34	347.05	.62	.03	.04	.69	1.00
1973	3,353	193.18	17.38	13.56	224.13	328.80	342.36	.56	.05	.04	.65	1.00
1974	3,397	125.86	22.70	18.06	166.62	263.51	281.57	.45	.08	.06	.59	1.00
1975	3,441	128.44	21.27	18.18	167.90	283.87	302.05	.43	.07	.06	.56	1.00
1976	3,485	141.38	25.34	13.63	180.36	315.95	329.59	.43	.08	.04	.55	1.00
1977	3,529	128.28	12.04	15.84	156.15	287.93	303.77	.42	.04	.05	.51	1.00
1978	3,573	138.55	18.36	7.58	164.49	273.50	281.09	.49	.07	.03	.59	1.00
1979	3,617	178.89	30.79	9.73	219.41	361.02	370.75	.48	.08	.03	.59	1.00
1980	3,661	191.66	19.23	8.18	219.07	353.74	361.92	.53	.05	.02	.61	1.00
1981	3,705	161.21	12.45	11.81	185.47	283.26	295.07	.55	.04	.04	.63	1.00

LOUISIANA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Context

The Louisiana economy is relatively dependent on the capital-intensive, goods-producing industrial sector. Economic growth has been concentrated in the mining, construction and manufacturing industries.

Personal income has grown at a much faster rate in Louisiana than it has in the nation as a whole. Despite high levels of growth, per capita income in the state remains below the national average.

Louisiana is expected to continue to grow at an above average rate over the next 20 years. Population is likely to increase at an average annual rate of 1.36 percent, less than the state's growth rate over the past 20 years, but 100 percent higher than that projected for the nation. The greatest growth within Louisiana is expected to occur in or near large metropolitan areas.

B. Capital Planning and Budgeting

According to a recent study of the Public Affairs Research Council, the criteria used for capital budgeting worked extremely well for determining needs for Louisiana's highways. In other functional areas, however, budgeting techniques are less successful.

Highway projects are evaluated after an objective review of the condition of highways and bridges. Determination of highway needs are made annually for the state maintained system and as required for all other roads. This periodic assessment of highway needs determines the priority of highway projects. The requests, after public hearings have been conducted, are included in the capital budget bill as a lump sum appropriation. The legislature is prohibited by law from adding or substituting projects, although it may delete projects from the highway program.

Non-highway capital outlays are adopted by the legislature in a comprehensive capital budget plan. A lack of emphasis on the scheduling of long-term projects to subsequently be considered in future years, however, causes most of the budget requests to be planned for the first year.

The state typically relies on a combination of federal grants, current revenues and debt financing for capital projects. Currently, the state has total authorized but unissued general obligation debt authority equal to $1.5 billion.

II. HISTORICAL CAPITAL INVESTMENT

Capital expenditures, as a percent of total expenditures, increased between 1973 and 1976. For the next couple of years, the capital share of the budget declined. Since 1979, the relative priority accorded capital items has been increasing.

State capital outlays excluding federal aid and debt financing have been declining if measured in real terms and relative to population. Per capita real spending went from $24.80 in 1974 to $18.13 in 1980.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* Louisiana waited until later than most states to develop a comprehensive road system. As a result, the system is newer and in better condition than average but significant gaps requiring new construction remain in the system. For example, there are 227 miles of interstate that need to be completed within the state.

In Louisiana, there are 56,676 miles of road. Of this, 16,389 miles or 29 percent are state maintained. Approximately 17 percent of the state maintained system is considered deficient.

The road system includes 15,339 bridges, 5,000 of which are deficient. Eighty percent of the deficient bridges are the responsibility of local governments.

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[1] Based on James D. Shilling, "Louisiana Public Infrastructure Study" (Baton Rouge, Louisiana: Department of Finance, College of Business Administration, Louisiana State University, June 1983).

To meet construction and maintenance needs on the state maintained road system, expenditures of $11.6 billion will be required through 2000. This includes $1.5 billion for interstate construction, $1.6 billion for overlay, construction and rehabilitation of current deficiencies, $6 billion of improvements, $3.3 billion for anticipated deficiencies and $4.5 billion for ordinary maintenance.

Assuming federal aid flows at levels consistent with the 1982 law, state general fund contributions are maintained as a constant percentage of total state tax revenues and bond outlays grow at the same pace as tax revenues, it is estimated that $11.2 billion will be available for investment on the state-maintained system. Investment needs exceed revenues by $451 million or $26.5 million per year.

Approximately $943.5 million should be spent in Louisiana for bridges between 1983 and 2000. This includes the cost of replacement and rehabilitation of bridges categorized as structurally deficient or functionally obsolete. The Federal Bridge Replacement Fund is expected to provide most of the revenues; estimates indicate that the current funding level is close to being sufficient to cover needs. Revenues are estimated to total $899 million through 2000, or approximately 15 percent less than investment required.

Local roads are estimated to require an investment of $6.78 billion. This assumes a surface life of 8–10 years and a resurfacing cost per mile of $79,200. It does not allow for significant upgrading or new construction. Even so, it is here that the greatest financing difficulties are expected to lie. Revenues are expected to total $5.7 billion, leaving a shortfall of approximately 15 percent.

2. *Airports.* Louisiana is served by 286 air facilities, 65 of which are publicly owned. Seven are "air carrier" airports providing scheduled passenger service. Capital investments needed to upgrade and maintain public airports are determined according to demand/capacity analysis. Based on this system, most of the smaller airports have been assessed as deficient in the areas of runway length, width, pavement strength and navigational equipment. A total of $68 million is judged necessary to improve public air facilities, almost all of which is needed over the next couple of years. Maintenance costs are not included in these figures.

Capital improvements are financed largely with federal grant funds. In FY 83–84, total revenue for airports are expected to equal $24.8 million. If this funding level continues, the state will easily be able to cover the cost of airport improvements.

3. *Railroads.* Louisiana has 3,435 miles of rail line, 92.9 percent of which is Class I. The rail system connects with the water transport system and is crucial in the handling of paper, wood, chemical and petroleum products. The state is also served by three Amtrak passenger routes.

The major public concern regarding rail is the likely abandonment of rail lines. It is estimated that $23.3 million might be required to cover rehabilitation efforts that could avert abandonment.

Since virtually all prior funding for efforts of this kind came from a federal program which is assumed to be terminating, no revenues are forecasted to be available. This means a shortfall equal to 100 percent of the needs estimated.

4. *Mass transit.* There are seven major urbanized areas in Louisiana which have public transit services. These systems have shown an increase in patronage in recent years but all have a substantial operating deficit.

A Louisiana mass transit study offers preliminary estimates of capital investment needs and operating expenses through 1990. If extrapolated through 2000, capital investments of almost $200 million are estimated. Operating expenses would exceed $1 billion.

The researchers estimate that $20.8 million might be available per year from federal sources and $12.5 million from state sources for mass transit purposes. This means that substantial funds must be raised at the local level if services are to be maintained. The difficulty, however, given restrictions in the use of federal funds, is more likely to come in finding funds to cover operating expenses than capital.

B. Water Supply, Distribution and Treatment

Louisiana, with an average rainfall of 50 to 60 inches per year, has an abundant natural supply of water. Water is supplied to users by a combination of public utilities, private utilities whose rates are set by the State Public Service Commission and rural nonprofit water utilities under the control of the Farmer's Home Administration.

Water use is expected to more than double between 1980 and 2000. The heaviest use of water is by industry.

No inventories of existing water supply systems or projections were available. Based on a study of actual investment per capita by water utilities in 1971, and assuming that required investments per capita have not changed in real terms, the researchers estimate future investment requirements of $308.8 million.

No estimates of revenues was provided.

C. Wastewater Collection and Treatment

The EPA needs assessment suggests it will cost $2.4 billion to meet the needs of the population in 2000 for wastewater collection and treatment.

D. Other Infrastructure

1. *Flood control.* Approximately one-quarter of all flood damage in the U.S. occurs in Louisiana. Flood control programs provide for the construction of structures which protect against headwater and backwater flooding. Traditionally, the federal government has assumed primary responsibility for investments designed to cope with this problem. Given reduced federal fund availability and delays in implementing federal projects, the state has begun to assume a more active role. No estimates of needed investment, however, are currently available.

2. *Solid waste.* The federal Resource Recovery and Conservation Act and Louisiana State law require that all solid waste be utilized for resource recovery, deposited in a sanitary landfill or otherwise disposed of in an environmentally safe manner. These regulations severly restrict the location of sanitary landfills in wetlands or flood plains. Since approximately half the state, housing more than two-thirds of the population, can be classified as a wetland or flood plain area, solid waste disposal siting presents some serious problems.

Solid waste generation is expected to increase at an annual average rate of 2.6 percent. To meet these demands, it is estimated that $89 million of capital costs will be needed to develop an effective parishwide collection and disposal system.

IV. SUMMARY AND CONCLUSIONS

Investment requirements in Louisiana for transportation, water supply and wastewater treatment through 2000 approach $22 billion, with nearly 87 percent in the transportation function. Revenues are estimated to total $18 billion leaving a shortfall of $4 billion. It should be noted, however, that no revenue estimate is included by the wastewater treatment function and no estimate of needs is provided for by water supply.

LOUISIANA'S CAPITAL INVESTMENT NEEDS AND ESTIMATED REVENUES: 1983–2000

[In millions of 1982 dollars]

Category of infrastructure	Needs	Revenues	Shortfalls
Total	22,065	18,404	3,660
Highways	11,639	11,188	451
Bridges	944	899	44
Local roads	6,780	5,740	1,040
Railroads	23	0	23
Airports	68	68	0
Mass transit	200	200	0
Water supply	n/a	309	–(309)
Wastewater treatment	2,411	n/a	(2,411)

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF LOUISIANA

[Dollar in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$203	$31	$28	$262	$433	$461	$587	$96	$82	$766	$1,207	$1,289
1970	229	30	20	279	432	452	602	87	55	744	1,112	1,167
1971	243	27	23	294	627	650	586	72	59	717	1,495	1,554
1972	259	16	24	299	573	596	600	38	56	694	1,291	1,347
1973	248	25	21	295	549	570	539	56	47	641	1,161	1,208
1974	283	19	26	328	574	601	480	36	50	566	1,031	1,081
1975	406	18	75	498	745	820	640	30	122	792	1,225	1,347
1976	462	38	71	571	942	1,013	735	61	109	905	1,506	1,615
1977	453	38	79	569	1,010	1,089	694	56	116	867	1,526	1,642
1978	369	34	37	459	811	848	476	46	49	571	1,095	1,144
1979	321	37	25	383	845	870	347	45	30	423	1,004	1,034
1980	469	36	33	538	1,063	1,095	444	40	36	520	1,133	1,169
1981	539	96	50	685	1,289	1,340	514	101	52	667	1,310	1,362

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,589	163.68	26.84	22.81	213.33	336.21	359.02	0.46	0.07	0.06	0.59	1
1970	3,645	165.06	23.85	15.07	203.98	305.16	320.23	.52	.07	.05	.64	1
1971	3,701	158.40	19.37	15.92	193.69	403.97	419.88	.38	.05	.04	.46	1
1972	3,757	159.72	10.22	14.91	184.85	343.55	358.46	.45	.03	.04	.52	1
1973	3,813	141.37	14.59	12.22	168.18	304.58	316.79	.45	.05	.04	.53	1
1974	3,869	124.10	9.28	12.94	146.32	266.46	279.39	.44	.03	.05	.52	1
1975	3,925	163.18	7.54	31.06	201.78	312.24	343.30	.48	.02	.09	.59	1
1976	3,980	184.56	15.35	27.36	227.27	378.36	405.72	.45	.04	.07	.56	1
1977	4,036	171.95	13.90	28.86	214.71	377.95	406.81	.42	.03	.07	.53	1
1978	4,092	116.25	11.20	12.07	139.51	267.48	279.55	.42	.04	.04	.50	1
1979	4,148	83.72	10.86	7.34	101.92	241.99	249.32	.34	.04	.03	.41	1
1980	4,204	105.54	9.57	8.63	123.75	269.55	278.18	.38	.03	.03	.44	1
1981	4,260	120.71	23.70	12.24	156.65	307.55	319.79	.38	.07	.04	.49	1

MAINE [1]

Profile of State Infrastructure Requirements

I. CONTEXT

Maine is a largely wooded, rural, sparsely populated and poor northeastern state in contrast to those more urbanized, southern New England states.

A. Demographic and Economic Conditions

Population growth has historically been slow. However, during the last decennial census period, the state's population increased by 13.2 percent in contrast to the 2.5 percent increase between 1960 and 1970. Continued modest growth is anticipated with the 1980 population of 1,125,000 increasing to 1,229,000 in 1990 and to 1,308,000 by the end of the century. The Maine economy is characterized by a relatively high dependence on natural resources, agriculture, fisheries, mining and tourism.

B. Infrastructure and Capital Expenditures

Maine has an extensive highway network needed to serve a large geographic area and scattered population. Although 61 percent of all housing units are served by public water systems, only half are connected to public sewers. The state as a whole has ample water supply, but parts of southern Maine may have shortages in the future. A recent survey of 292 rural municipalities found that 176 had problems with solid waste disposal and 109 had difficulties with sewage treatment and disposal.

A large part of Maine's annual expenditures for infrastructure are met by user charges. For example, in 1981 about 55 percent of state and local government revenues used for highways came from gasoline tax, licenses, service charges and turnpike tolls. For instance, the state recently raised the gasoline tax from $0.09 to $0.14 per gallon. Water utilities received a similar proportion of their expenses from user charges. Sewerage, transit, airport and port agencies also obtain a significant part of their revenues from fares, fees, rentals and similar charges. The balance of revenues comes from federal grants, the state general fund or municipal property taxes.

Bonding by state local agencies is the principal means of financing large capital outlays. A bond issue of $24.6 million for highway and bridge improvements was passed in 1983, and another bond issue of $18.4 million for other projects was on the November 1983 ballot. Other more innovative bonding mechanisms are being considered by state and local governments.

II. HISTORICAL CAPITAL INVESTMENT

Maine's capital outlays by state and local governments for highways, other transportation, water supply, sewerage and sanitation averaged over $100 million per year (in 1977 dollars) between 1960 and 1973. Spending dropped to $85 million in 1974 and 1975, peaked in 1977 at $164 million due to a large infusion of federal funds for sewage treatment plants, and dropped to a new low of $70 million in 1981.

Capital Outlays for Highways, Water Supply, Sewerage, and Other Utilities and Transit

[In millions of 1977 dollars]

Year:	*Total*
1977	164.6
1978	124.8
1979	124.8
1980	88.7
1981	70.1

The decline in capital outlays was prevasive with substantial drops in expenditures being recorded in highways, water and sewerage.

Real per capita outlays for infrastructure and similarly at new lows dropping to $62 per capita in 1981 from $152 in 1977 and $100 in 1970. The mix of expenditures shows a dramatic shift over these years due to the major expenditures on water and especially sewerage in 1977:

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[1] Based on Carol E. Veazie, Senior Economist, "Maine's Infrastructure Needs, 1982-2000, A Case Study," (Center for Research and Advanced Study, University of Southern Maine: September 1983).

PER CAPITA EXPENDITURES

[In 1977 dollars]

Infrastructure	1970	1977	1981
Highways	83	56	40
Sewerage	12	75	15
Water supply	5	20	7
Total	100	151	62

During the 1977 to 1981 period, capital outlays averaged $143 million in current dollars per year while operation and maintenance of those facilities averaged an additional $158 million. Revenues for infrastructure averaged $290 million per year, of which 31 percent came from federal sources.

Outstanding long-term debt of state and local governments (including debt for education) rose from $936 million in 1977 to $1,402 million in 1982.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

Transportation components addressed in the Maine study include highways and bridges, railroads, mass transit, airports and ports.

1. *Highways and bridges.* Maine's highways mileage totaled 21,921 in 1981. Of this, 19,699 miles are classed as rural and 2,203 are classed as municipal. Based on national standards, the Maine Department of Transportation estimates that 63 percent of the miles of highways evaluated throughout the State needs improvements costing about $428 million in 1982 dollars. The state has 4,079 bridges. Repairs or reconstruction costs are estimated to be $170 million. Estimates of additional needs for highways and bridges from 1990 to 2000 total nearly $1.0 billion.

During the 1977 to 1981 period, highway program revenues came from the Federal government (24 percent), the State Highway Fund (51 percent), turnpike tolls (8 percent), and local excise taxes (17 percent). Maine's recently enacted $0.05 increase in the gasoline tax, plus increased user charges, are expected to be sufficient to finance proposed improvements during the 1982 to 2000 period. State and local governments are expected to provide an additional $810 million. Thus, the total funds available for highway and bridge capital outlays should be sufficient to meet needs.

2. *Railroads.* Rehabilitation needs for railroad lines and crossings are estimated to be $35 million during the 1982 to 2000 period compared with revenues of $22 million. There will, therefore, be a revenue gap of about $13 million for the period in 1982 dollars.

3. *Mass transit.* Public transportation needs identified for 1984 and 1985 include buses, a ferry on Penobscot Bay, and a Casco Bay ferry terminal. It is estimated that capital needs for the 1982 to 2000 period will total about $40 million of which $35 million will be covered by prospective revenues leaving a $5 million revenue gap for the period.

4. *Airports.* It is estimated that infrastructure needs for airports will amount to $125 million in 1982 dollars over the 1982 to 2000 period, but revenues are anticipated to be sufficient to meet these needs.

5. *Ports.* State and federal money is being used to finance various port developments including fish piers, a shipbuilding facility, and cargo piers. It is estimated that the identified capital needs of $96 million in 1982 dollars will be covered by revenues of $85 million leaving a revenue gap of $11 million.

B. Water Supply, Distribution and Treatment

Water utilities serve only 61 percent of the state's housing units and a fraction of the state's industries. Three-fourths of the state's utilities are publicly-owned and one-fourth private. These utilities spent $197 million during the 1977 to 1981 period, of which $112 million represented capital improvements. While potential shortages of water have been identified, no cost estimates associated with needed improvements have been made.

C. Wastewater Collection and Treatment

The Maine Department of Environmental Protection has estimated priority needs for sewage to be $102 million in 1982 dollars for the years 1983 to 1987. Additional needs of $119 million are anticipated by the end of the century. The U.S. Environmental Protection Agency has identified additional needs totaling $1.5 billion by 2000, primarily for segregating sanitary and storm sewers, constructing more treatment facilities and collectors, and rehabilitating existing sewers. It is estimated that the state-identified needs could be financed by prospective state and federal revenues; however, the needs identified by EPA cannot be funded under existing programs and thus constitute a revenue gap of $1.5 billion.

D. Solid Waste

A $96 million revenue gap is reported for solid waste disposal. The rationale is that this is the cost for 11 regional energy recovery facilities and no state or federal funding has been proposed, hence a gap exists.

IV. SUMMARY AND CONCLUSIONS

Total identified infrastructure capital needs for the 1982 to 2000 period are estimated to be $3.8 billion in 1982 dollars:

Maine Infrastructure Needs

[In millions of 1982 dollars]

Infrastructure:	*Estimated cost*
Highways and bridges	1,702
Railroads	35
Public transit and ferry	40
Airports	125
Ports	96
Water supply	n/a
Sewerage: State	221
EPA	1,524
Solid and hazardous waste	96
Total	3,839

Revenues will be insufficient to meet these estimated needs. Totals during the period are projected to be $1.2 billion from federal sources and $1.0 billion from state and local revenue sources, or total revenue of $2.2 billion. Thus, a gap of $1.6 billion is anticipated for the state of Maine. Most of this gap is caused by the extensive sewerage projects recommended by the EPA for which no funding has been programmed.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF MAINE

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$42	$5	$4	$50	$94	$98	$120	$15	$12	$147	$262	$274
1970	48	6	3	57	104	107	126	18	7	152	268	275
1971	63	5	6	73	129	134	151	12	14	177	307	321
1972	73	5	7	85	115	121	169	11	16	196	258	274
1973	61	13	7	81	129	136	133	28	15	176	273	288
1974	60	13	6	78	146	152	101	24	12	137	262	274
1975	58	18	6	82	144	150	92	30	9	131	237	246
1976	61	33	6	100	162	168	97	53	9	159	259	268
1977	61	81	22	164	204	226	93	122	33	248	307	340
1978	64	44	30	139	171	201	83	60	40	184	231	271
1979	81	20	26	127	180	206	88	24	31	143	214	245
1980	94	15	24	133	182	205	89	17	26	133	194	220
1981	71	24	11	105	182	193	67	25	11	103	185	196

Fiscal year	Population (thousands)	Per capital real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	981	122.38	15.09	11.92	149.38	267.28	279.20	0.44	0.05	0.04	0.54	1.00
1970	994	127.24	18.13	7.22	152.60	269.52	276.74	.46	.07	.03	.54	1.00
1971	1,007	149.59	11.95	13.87	175.41	305.28	319.15	.47	.04	.04	.54	1.00
1972	1,020	165.58	10.85	15.82	192.25	253.19	269.02	.62	.04	.06	.54	1.00
1973	1,033	128.57	27.35	14.24	170.15	264.38	278.62	.46	.10	.05	.54	1.00
1974	1,046	96.88	22.69	11.18	130.75	250.56	261.74	.37	.09	.04	.54	1.00
1975	1,060	86.80	28.08	8.77	123.65	223.61	232.38	.37	.12	.04	.54	1.00
1976	1,073	90.51	49.55	8.49	148.54	241.14	249.63	.36	.20	.03	.54	1.00
1977	1,086	85.96	112.18	30.01	228.15	283.17	313.18	.27	.36	.10	.54	1.00
1978	1,099	75.60	54.98	36.56	167.13	209.93	246.48	.31	.22	.15	.54	1.00
1979	1,112	79.10	21.41	28.25	128.76	192.35	220.60	.36	.10	.13	.54	1.00
1980	1,125	79.30	15.34	23.46	118.10	172.02	195.48	.41	.08	.12	.54	1.00
1981	1,138	59.17	21.92	9.54	90.64	162.60	172.14	.34	.13	.06	.54	1.00

MARYLAND [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economy

Maryland's population grew 7.5 percent during the 1970s to 4.2 million. It is expected to rise to nearly 4.8 million by 2000, an increase of 13 percent. Approximately 80 percent of the state's population is located in either the Baltimore or Washington D.C. Metropolitan areas.

Employment is expected to grow 60 percent faster than population as a larger fraction of the population enters the labor force. The shift from manufacturing to service section jobs is expected to continue. In general, Maryland's economy can be described as diversified and relatively stable.

B. Capital Planning

Maryland has a relatively simple structure of local governance with its counties having primary responsibility for infrastructure decisionmaking. County governments vary in sophistication; many of the urban counties have formal capital planning and budgeting procedures but most rural counties do not.

The Maryland Department of State Planning commissioned a survey of local infrastructure planning efforts in 1982. The survey found that the information on capital facilities was poor and that its use in an effective planning framework was weak.

II. HISTORICAL CAPITAL INVESTMENT

For highway, sewerage and water supply functions, spending by Maryland governments decreased in real terms over the course of the last decade. Water and sewer spending declined during the middle of the decade but increased later. Highway spending showed a downward trend over the entire period.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* Maryland's highway system is a dual system with state responsiblity for some 5,258 miles and county or municipal responsibility for 26,000 miles. State highway construction and maintenance are financed via a trust fund, fed in part by a gasoline tax of 13.5¢ per gallon. Local governments also receive a part of trust fund proceeds.

Using standards established by the American Association of State Highway and Transportation officials, the state undertook a comprehensive assessment of its part of the road system in 1980. It found that 40 percent of its roads were deficient in terms of safety, service or structural condition and concluded that $6.9 billion would be required to eliminate deficiencies. Of the 2,152 miles found to be deficient, 20 percent require new construction but since the costs associated with new construction are so much higher, 38 percent of required investments fall in the new construction category.

When asked for a qualitative assessment of road conditions within their jurisdiction, most county officials responded "good." It is probable that most problems on local roads can be handled by resurfacing rather than reconstruction. This is estimated to cost $6.6 billion.

Maryland's bridges are in worse condition than its highways. County officials were more likely to assess the conditions of bridges as fair, rather than good. Using national standards, 944 bridges within the state have been identified as being structurally deficient and another 540 as functionally obsolete. The cost of eliminating these deficiencies is estimated to be $674 million.

When the highway and bridge needs are combined for both state and local systems, the total need estimate is $14.2 billion.

Two sets of revenue projections are presented. One assumes that the current level of infrastructure spending is maintained while the other assumes that the 10-year trend in spending will continue. The researchers conclude that between $7,254 million and $8,953 million will be available for investment in the state and local road system. This leaves a gap of between $5.3 and $6.9 billion.

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[1] Based on David L. Puryear, "Maryland Public Infrastructure Needs," (Baltimore, Maryland: Center for Metropolitan Planning and Research, The Johns Hopkins University, October 1983).

2. *Water transportation.* The port of Baltimore is the second largest container port on the North Atlantic Coast and is crucial to the Maryland economy. To attract containerized cargo, it is necessary to invest in modern container handling facilities. Approximately 70 percent of containerization cargo now handled goes through state-owned terminals. The state's plan calls for completion of several additional berths which will increase the capacity of state-owned terminals from 3.5 to 10 million tons. This expansion is expected to cost $283 million. The Baltimore Port also requires dredging of its main channel—a project estimated to cost some $300 million. Since such projects have traditionally been undertaken by the federal government, this project is not included in the needs estimate. On the other hand, there is some concern because the project has been delayed due to a lack of available funds at that level.

No revenue estimates were provided.

3. *Air transportation.* The Baltimore-Washington International Airport continues to experience growth in both passenger traffic and air cargo tonnage. Currently planned capital projects are expected to cost $31 million. No other major projects are likely until the federal government resolves its plans for National and Dulles airports, which are BWI's major competitors for air traffic. No estimate was provided for other airports in the state.

No revenue estimates were provided.

4. *Mass transit.* Between 1983 and 2000, an investment of $1,084 million will be required for mass transit. Almost all of the cost ($940 million) is attributable to planned subway construction in the Washington and Baltimore metropolitan areas. Approximately 140 million is required for replacement of aging buses and rehabilitation of bus garages.

No revenue estimates were provided.

B. Water Supply, Distribution, and Treatment

Maryland is served by some 625 water supply systems which provide water for more than 90 percent of the state's 4.2 million residents. The two largest systems alone serve 70 percent of the population. Local governments are generally satisfied with the quality and condition of their water systems; only three rated their systems as less than good but one of these was Baltimore. The state government estimates that the total cost of repairs and improvements to existing systems is $117 million. The cost of water supply for new growth areas is substantially higher at $516 million.

Based on past spending patterns, the researchers estimate that between $1.7 and $1.8 billion should be available to finance water system improvements. This is substantially more than is required to meet identified needs.

C. Wastewater Collection and Treatment

The state estimates that an investment of $727 million is required to remedy problems with existing sewer systems. New growth needs total $822 million.

The researchers note that several counties have removed sewer systems from their development plans in recent years, particularly where the area is already served by septic systems. This reluctance to connect to the system arises from dramatic increases in sewer construction costs and hookup fees.

Based on past expenditure levels, the researchers estimate that between $3.258 million and $3,443 million should be available for sewerage investment. This revenue total is higher than the projected needs estimate of $1,609 million.

IV. SUMMARY AND CONCLUSIONS

In order to meet its needs in the transportation, water and sewer functions, Maryland governments must invest almost $18 billion over the next 18 years. Transportation accounts for the great bulk (87 percent) of the identified needs. It is also the area where the state foresees some difficulty in raising revenues. Even though it has changed its gasoline tax to an ad valorem basis, the state projects that revenues available for highway and bridge investments will fall short of needs by some $7 billion and will have to double in order to make all of the investments required to insure an adequate road system.

SUMMARY OF CAPITAL INVESTMENT NEEDS AND RESOURCES, 1983–2000

[In millions of current dollars]

	Needs	State and local revenues	Revenue surplus (shortfall)	Average annual revenue surplus (shortfall)
State highways	6,930			
Local highways	6,617	7,254	(6,967)	(387)
Bridges	674			
Mass transit	1,068			
Airports	31	1,128	(270)	(15)
Railroads	16			
Port of Baltimore	283			
Water supply	633	1,710	1,077	60
Sewerage	1,609	3,443	1,834	102
Total	17,861	13,535	(4,326)	(240)

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF MARYLAND

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$167	$83	$42	$292	$564	$606	$483	$260	$123	$1,349	$1,570	$1,693
1970	97	36	28	161	564	592	256	104	77	951	1,452	1,529
1971	264	40	28	332	728	756	636	106	71	1,497	1,736	1,807
1972	213	68	39	320	717	757	493	160	93	1,409	1,617	1,710
1973	266	79	39	383	790	828	577	172	86	1,578	1,669	1,755
1974	332	96	45	474	968	1,013	563	183	87	1,759	1,737	1,824
1975	335	176	45	556	1,174	1,219	528	297	74	2,044	1,931	2,005
1976	373	158	34	564	1,184	1,218	593	252	52	2,063	1,893	1,945
1977	325	114	32	471	1,122	1,154	499	171	47	1,823	1,695	1,741
1978	314	122	45	480	1,138	1,183	404	166	60	1,754	1,537	1,597
1979	332	116	68	516	1,157	1,225	359	141	83	1,725	1,374	1,457
1980	445	139	97	680	1,375	1,472	421	156	107	2,048	1,466	1,574
1981	403	181	95	679	1,177	1,272	384	191	98	1,847	1,196	1,295

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,895	124.02	66.85	31.60	222.48	403.10	434.70	0.29	0.15	0.07	0.51	1.00
1970	3,924	65.14	26.53	19.70	111.36	369.99	389.69	.17	.07	.05	.29	1.00
1971	3,953	160.79	26.74	17.86	205.38	439.12	456.98	.35	.06	.04	.45	1.00
1972	3,982	123.71	40.15	23.31	187.17	406.04	429.35	.29	.09	.05	.44	1.00
1973	4,012	143.94	42.98	21.39	208.31	416.13	437.53	.33	.10	.05	.48	1.00
1974	4,041	139.41	45.26	21.45	206.12	429.90	451.35	.31	.10	.05	.46	1.00
1975	4,070	129.79	72.90	18.18	220.87	474.46	492.63	.26	.15	.04	.45	1.00
1976	4,099	144.62	61.41	12.68	218.71	461.89	474.57	.30	.13	.03	.46	1.00
1977	4,128	120.75	41.35	11.36	173.46	410.47	421.83	.29	.10	.03	.41	1.00
1978	4,158	97.26	39.98	14.44	151.69	369.72	384.16	.25	.10	.04	.39	1.00
1979	4,187	85.66	33.77	19.74	139.17	328.27	348.01	.25	.10	.06	.40	1.00
1980	4,216	99.76	37.01	25.49	162.26	347.76	373.25	.27	.10	.07	.43	1.00
1981	4,245	90.48	44.94	23.20	158.61	281.80	305.00	.30	.15	.08	.52	1.00

MASSACHUSETTS [1]

Profile of State Infrastructure Requirements

I. CONTEXT

The Commonwealth of Massachusetts is the site of many of the nation's earliest settlements. It was an early leader in the public provision of infrastructure. Boston, for example, began to lay America's first piped water system in 1652, developed the nation's first subway before 1900 and some decades later built Route 128, the first limited access circumferential. Now, the commonwealth must cope with the fact that much of its infrastructure is aged and in need of substantial rehabilitation and repair.

A. Population Economy and Fiscal Condition

The state's economy has been undergoing a structural shift from a dependence on manufacturing to services and high-tech industry. These new activities tend to be dispersed, so recent patterns of central city population decline combined with nonmetropolitan population growth are expected to continue.

While the state's economic future looks brighter than it has for some years, the fiscal position of its governments is somewhat more tenuous. State revenues have been weak due to the national recession at the same time that local governments face severe constraints due to Proposition 2½.

B. Capital Planning and Budgeting

The researchers reported great difficulty in obtaining data needed to evaluate infrastructure condition or project future needs. State agencies could provide some information on state maintained systems but knew little about conditions at the local level. Contacts with regional commissions with direct operational responsibility for infrastructure yielded some information. Regional Planning agencies were, however, generally unable to respond to requests for information on infrastructure within their territories.

Where information was available on capital needs, it was generally in the form of a capital improvement programs consisting of specific projects that had already received approval at least by the administering agency. While not all projects would have received financial commitments, these capital improvement programs clearly reflect strong financial and political constraints. In other words, many of the Massachusetts estimates, particularly in the transportation function, are not standard-based unconstrained needs estimates.

The researchers note that most maintenance expenditures are being deferred, forcing a crisis response rather than planned maintenance. Also, the completion date of a fair number of projects is being delayed due to a lack of funds.

Financing for much of the infrastructure covered by this study is dependent on federal grants and at the state and local level by bond proceeds.

II. HISTORICAL CAPITAL INVESTMENT

Over the past decade, capital investment in Massachusetts has declined in real terms. Much of the decline affected highways and bridges, where capital spending decreased in real terms from $672 million in 1970-71 to $516 million in 1980-1981. Investment in water systems remained relatively constant in real terms while expenditures for sewerage systems increased.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* Massachusetts has 33,780 miles of roadway, 60 percent of which are classified as local roads and streets. Pavement deficiencies were reported for the 33 percent of roads comprising the federal-aid system. Of these, 39 percent of road mileage is in good condition, 53 percent in fair condition, 7 percent deficient and 2 percent in complete disrepair.

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[1] Based on Karen R. Polenske; Gerald Sussman; Richard D. Tabors; Lynn C. Todman and Adrian R. Walter, "An Assessment of Public Infrastructure in Massachusetts," Joint Center for Urban Studies of the Massachuesetts Institute of Technology and Harvard University, Cambridge, Massachusetts, September 1983.

The researchers reported that capital and maintenance programs at the state level generally did not extend beyond a six month to one year time frame. Using a single year estimate of programmed projects, the researchers estimated needs to 2000 of $5.4 billion. To this they add $1 billion to cover construction of a new tunnel crossing Boston Harbor and $1.5 billion to cover construction of the depression of the central artery. No estimates of need were available for the portion of the road system which is locally maintained.

The road system also includes 5,000 bridges, 56 percent of which are under state jurisdiction. The average bridge age is 40 years. Using ratings developed by the American State Highway Transportation Officials (ASHTO), 20 percent of bridges are found to need immediate rehabilitation or replacement while another 30 percent need substantial rehabilitation. Figuring a cost of between $250,000 and $500,000 per bridge, depending on the extent of work required, needs were estimated at $900 million through 2000.

If the revenue projection is based on an optimistic view of federal funds available, then it appears Massachusetts road and bridge needs will be more than met (surplus of $2.1–$2.5 billion). If on the other hand, the federal funds projection is based, not on obligation levels, but on the portion of obligated funds actually utilized, then revenues may fall short of needs by as much as $1.2 billion.

2. *Mass transit.* The Massachusetts Bay Transportation Authority is the primary conveyor of public transportation services in the Commonwealth. It serves 79 cities and 168 million passengers annually in the eastern part of the state. It maintains rapid transit, light rail, commuter rail, bus and trackless trolley services. Transit services are provided in an additional 154 cities and towns to 32 million passengers annually by several additional Regional Transit Authorities. In general, transit ridership has been increasing over the last several years.

There is extensive information available on the capital inventory of the MBTA. On the other hand, researchers found that the organization engaged in crisis maintenance, with little focus on establishing preventive maintenance/replacement priorities on a long term basis.

MBTA is currently implementing a program of expansion and upgrading of its rapid transit system. The addition of 8.4 miles and several stations is projected to cost $2 billion and will be completed by 1987. Other aspects of the improvement program include a power program (to replace and upgrade cable conduits and power distribution facilities), track and signal upgrading, ventilation and tunnel work. MBTA also plans to purchase additional light rail vehicles and new buses, to replace older ones now in use.

The capital improvement program includes specific projects as outlined above with estimated costs. The program is not designated to be achieved within a specific time frame; the timing will depend both on their own ability to implement projects and federal funds availability. Indeed, the local system views its ability to function as entirely dependent on UMTA grant funds.

Based on the capital improvement programs in place, and the uncertain time frame, the researchers were only able to estimate needs through 2000 in terms of a broad range from $2.8 to $7.2 billion. Revenues of $1.3 billion are forecasted, leaving a shortfall of $1.4 to $5.9 billion. (The basis of the revenue estimate is uncertain but may reflect commitments in place for ongoing multi-year capital projects).

3. *Railways.* The analysis of railways focuses on three aspects where there is strong public involvement: commuter rail, state-owned rail grades and crossings, and state-owned railroad bridges and tunnels.

Approximately 35 percent of total rail route mileage in the state is used for daily commuter or intercity passenger traffic. Service is provided to nine million passengers a year. Traditionally the rail lines were privately owned. Over the last 20 years many of the commuter lines have been at or near bankruptcy and the public sector has stepped in to insure continued operations. Indeed, a major reason for the formation of the Regional Massachusetts Bay Transportation Authority in 1964 was to provide subsidies to financially ailing commuter rail. Over the years, it has acquired ownership and management responsibility for a significant share of commuter rail. MBTA owns 240 route miles of active commuter lines—906 track miles overall if such things as sidings, yards, etc. are counted. It also owns a significant amount of rolling stock and two maintenance facilities. Based on a short-term capital improvement program, the researchers estimate year 2000 needs at $780 million. They forecast revenues of $162 million, $518 million less than the required level of investment.

Between 1975 and 1983, the state budgeted outlays of $33.1 million for 387 railroad crossing projects. No estimate of future needs was provided.

The state owns 25 of the 420 railroad bridges and tunnels in the state. Seventy-two percent are rated as being in less than desirable condition but no estimates were available on the cost of repair or rehabilitation.

4. *Airports.* Massachusetts relies on 66 airport facilities, each of which is 35 years old or more. The system is deemed adequate to meet projected demand through 1990 and possibly through 2000 as well. Based on short range capital improvement programs, the researchers estimate annual investment needs of $145 million or $2.4 billion through 2000. No estimate of revenues was provided although federal funds are expected to pay a substantial share of project costs.

B. Water Supply, Distribution and Treatment

Massachusetts' problem in this area is that of a "mature system where the most easily tapped sources of water have long been utilized and the water distribution system is old and in need of repair."

Water supply is traditionally a function of local authorities. There are now 363 water supply systems serving 293 cities and towns and 93 percent of the state's population. Of these, 217 are municipal water departments, 78 are fire and water districts and 68 are private companies. While primary responsibility does rest at the local level, there is a history of state involvement in facilitating solutions to thorny problems of supply or delivery. Most notably, the state mandated the water-rich western part of the state to share its water with the more populous east and authorized formation of a Metropolitan District Commission to develop those water sources and transmit the water cross state to local distribution networks.

The state has problems both of supply and distribution and the two are perceived to be linked since supply can be enhanced by reducing losses from leakage and waste. Evidence of problems on the supply side stems from the drought which occurred between 1979 and 1981 when 42 communities operated under state declared water emergencies and 19 more implemented water restrictions on a voluntary basis. Also, the Metropolitan District Commission's water supply needs augmentation; the daily draw now exceeds the daily safe yield of the system. Studies are now underway to assess alternative methods of increasing supply but no cost estimates are available.

On the distribution side of the equation, problems are attributable mainly to age. Antiquated pipes lead to leakage which in turn strains supplies, lowers pressure for adequate fire protection and in some instances, results in a degradation of water quality. A special legislative commission cited the problem of old water pipes as the "single greatest need" of older cities and towns.

Water pipes, even if quite old, can often be repaired. Those made of cast or ductile iron are subject to "tubercuation" which cuts pressure and results in quality degradation. In-place cleaning and cement mortar lining can solve problems at about half the cost of replacement (Boston estimates $56 per foot for rehabilitation and $122 for replacement). In some instances, the old mains are simply too small to serve current populations and replacements are required.

The state has enacted a program to help local communities deal with water distribution problems. Using bond financing, it will make funds available to communities for "leak detection and system rehabilitation." Thus far, applications for assistance for exceed available state funding.

The researchers estimate water supply investment needs of $65 million per year, or $1.2 billion through 2000.

C. Wastewater Collection and Treatment

"The sewerage treatment portion of the infrastructure is fairly well documented both in terms of existing facilities and projected needs, but the locally funded and administered sewage collection systems in the cities and towns (outside the MDC system) are almost completely undocumented and unstudied . . ."

The EPA estimate of backlog needs is $4.7 billion, with an additional $3.2 billion needed to meet year 2000 population needs. The state has made the clean-up of Boston Harbor one of its highest priorities. The state government has traditionally assumed responsibility for meeting part of the match required of local governments for participation in the EPA construction grant program.

Sources. Based on the 1980 census, about 88 percent of the year-round households in the state were supplied with water from a public system or private company.

IV. SUMMARY AND CONCLUSIONS

The Commonwealth of Massachusetts shows a need for capital investment through 2000 of between $22.7 and $28.6 billion. This figure reflects a conservative view of transportation needs both because local roads are excluded and because it is based largely on a "revenue constrained" capital improvements program rather than a "standards-based" needs assessment.

The researchers forcast revenues of between $10.2 and $13.9 billion but these figures do not include either airport revenues or local funds for water supply and hence should be used with caution.

SUMMARY OF CAPITAL INVESTMENT NEEDS AND REVENUES IN MASSACHUSETTS, 1983–2000

[In millions of 1982 dollars]

	Average annual need	Total needs through 2000	Revenues	(Shortfall) or surplus
Total	1,139–1,490	22,720–28,620	n/a	n/a
Highways and bridges	300–400	8,800	6,119–9,818	(2,681)–1,018
Public transit	155–406	2,800–7,200	1,260	(1,440)–(5,940)
Rail	43	780	162	518
Airports	115	2,390	N/A	N/A
Water supply	65	1,150	[1] 306	n/a
Wastewater	461	[2] 3,300	2,331	(5,969)

[1] Includes state funds only.

[2] Revised from researchers estimate to increase comparability with other states. Researchers original figure only included "backlog" needs reported in EPA needs survey, rather than year 2000 population needs.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF MASSACHUSETTS

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$173	$25	$13	$211	$545	$558	$500	$80	$38	$618	$1,519	$1,558
1970	224	31	22	277	677	699	588	90	61	740	1,745	1,806
1971	198	51	25	273	765	789	476	133	63	672	1,823	1,886
1972	167	68	31	267	913	944	387	160	74	621	2,058	2,132
1973	165	55	28	248	972	1,000	357	120	62	540	2,055	2,118
1974	185	52	32	269	956	988	313	99	61	473	1,716	1,777
1975	199	48	104	350	910	1,013	314	81	169	563	1,497	1,666
1976	213	89	48	350	905	953	339	142	74	555	1,447	1,520
1977	216	78	40	334	731	771	330	117	59	506	1,105	1,164
1978	239	126	51	416	779	830	309	172	68	548	1,052	1,119
1979	239	207	54	500	943	997	259	251	65	575	1,121	1,186
1980	270	174	68	511	882	949	255	195	75	526	940	1,015
1981	313	146	62	521	961	1,022	299	153	64	516	976	1,040

	Population (thousands)	Per capital real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	5,684	87.98	14.07	6.74	108.79	267.28	274.02	0.32	0.05	0.02	0.40	1.00
1970	5,689	103.44	15.89	10.72	130.06	306.68	317.41	.33	.05	.03	.41	1.00
1971	5,694	83.61	23.39	11.01	118.02	320.26	331.27	.25	.07	.03	.36	1.00
1972	5,699	67.93	28.10	13.00	109.03	361.16	374.16	.18	.08	.03	.29	1.00
1973	5,703	62.61	21.13	10.94	94.68	360.39	371.33	.17	.06	.03	.25	1.00
1974	5,708	54.85	17.37	10.68	82.90	300.55	311.24	.18	.06	.03	.27	1.00
1975	5,713	54.89	14.15	29.58	98.61	261.98	291.56	.19	.05	.10	.34	1.00
1976	5,718	59.29	24.82	12.87	96.98	252.99	265.86	.22	.09	.05	.36	1.00
1977	5,723	57.74	20.39	10.31	88.44	193.06	203.36	.28	.10	.05	[illegible]	1.00
1978	5,727	53.87	29.98	11.79	95.63	183.66	195.45	.28	.15	.06	.49	1.00
1979	5,732	45.16	43.82	11.41	100.38	195.53	206.94	.22	.21	.06	43	1.00
1980	5,737	44.44	34.07	13.10	91.62	163.88	176.98	.25	.19	.07	.52	1.00
1981	5,742	52.05	26.73	11.12	89.89	170.00	181.11	.29	.15	.06	.50	1.00

MISSOURI [1]

Profile of State Infrastructure Requirements

I. CONTEXT

Missouri is often referred to as a border state. The eastern border is formed by the Mississippi River and is the site of the nation's 12th largest city, St. Louis. The western border is also partially formed by a river and is the site of Kansas City, Missouri, the 29th largest city in the country.

Socioeconomic context. Growth in state personal income is a surrogate measure for economic growth. From 1970 to 1980, Missouri personal income grew at an annual average rate of 9.9 percent in contrast to the nation's overall growth rate of 10.4 percent. Historically, the rate of economic growth in the state has not kept pace with the overall rate of growth of the national economy and, based on recent data, this difference may be widening. The state has suffered disproportionately in the national economic decline largely due to the state's industrial mix which boasts a large number of durable goods manufacturers but few fast-growing, high-tech employers.

In terms of population growth, the Missouri trend mirrors the economic trend. Based on the 1980 census data, the state's population growth during the 1970s was slightly less than one-half that of the national rate—0.5 percent versus 1.1 percent.

State and local government finances. In 1977, there were 2,937 local governments in Missouri. Missouri has roughly twice as many local units as the average state, either in total numbers or in terms of number of local governments per 100,000 population. In 1980, Missouri ranked 44th out of 50 states in terms of per capita total state and local general revenues and expenditures, and 30th in terms of per capita income. Missouri is often considered a low-tax, low-service-level state. Compared with national per capita figures, Missouri per capita taxes fall consistently behind:

PER CAPITA TAXES, FISCAL YEAR 1981

Type of tax	Missouri	National
Property taxes	$126	$187
General sales and taxes	121	139
Income taxes: individual and corporation	106	151

Effective January 1, 1983, Missouri's general sales tax was raised to four percent, up from three percent. In addition, a number of local cities and counties have adopted local sales taxes as a method of bolstering local revenues. For example, the total sales tax in Kansas City is six and one-eighth percent including a one-half percent earmarked for local capital improvement projects.

The other approach taken to raise revenues has been the adoption of user charges. From 1977 to 1981, receipts from charges grew 72 percent. This popular method of raising revenue may reach a point of diminishing returns, however; continued growth in this revenue source will not likely parallel recent trends.

The state passed in 1982 Constitutional Amendment No. 1 which authorizes the state to issue $600 million in bonds. According to the amendment, the bonds are to finance infrastructure needs in three basic areas: (1) economic development, (2) repairs and maintenance of existing facilities, and (3) new construction which is not to exceed 65 percent of the total. To date (September 1983), the legislature has authorized $100 million of the total; the remaining $500 million in bonds are anticipated to be sold over the 1983 to 1987 period.

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

Transportation components addressed in the Missouri study included roads, bridges, mass transit, ports and airports.

1. *Highways.* The public road and street mileage in the state of Missouri totals 118,965 miles, the 7th largest system in the country.

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[1] Based on L. Kenneth Hubbell, "Missouri Infrastructure Needs: 1982-2000," (University of Missouri-Kansas City, Kansas City, Missouri: September 1983).

Total highway disbursements in 1980 amounted to $738 million by all units of government. This includes capital outlays, maintenance, administration, public safety and debt expense. Of the total, $317 million was in the form of capital outlays. The capital outlay trend has remained virtually flat in current dollars over the 1976 to 1980 period. In constant dollars, capital outlays fell by one-fourth over the period. Unlike the capital outlay trend, maintenance expenses have increased 48 percent from 1976 to 1980 in current dollars. One possible reason for this increase is that maintenance expenses (e.g., snow removal, sign repair, litter cleanup) are more difficult to postpone or delay while, unfortunately, capital outlays can be postponed to achieve some short-term savings—at the expense of greater long-term cost.

In Missouri, roads are financed from several basic sources: user taxes, tolls, appropriations from general funds, property taxes and miscellaneous receipts. The chief source of financing is user-related taxes and fees (motor fuel taxes, motor vehicle licence fees, vehicle sales taxes, federal highway funds)—72 percent of 1980 revenue. The motor fuel tax in Missouri is $0.07; a November 1982 unsuccessful proposition would have raised the rate to $0.11 per gallon. Only two states have a motor fuel tax lower than Missouri's. Fuel conservation has lessened the contribution of this tax source significantly. In 1977, 45 percent of the highway revenues were from the motor fuel tax. In 1981, the percentage had dropped to 30 percent.

Since the last road bond in 1957, Missouri has financed its highway programs entirely from highway-use revenues. Local governments, on the other hand, have made use of voter-approved bond issues more recently and more frequently. However, the major stumbling block for the state is a constitutional requirement that all general obligation bonds be approved by a two-thirds majority (Missouri is one of only five states requiring such a large approval rate for passage).

The Missouri Highway and Transportation Department is responsible for the state's highway system as well as airports, rail facilities, ports and transit systems. Highway needs are based on the Highway Performance Monitoring System which found 20,895 miles or 58 percent of the total HPMS miles in Missouri to be deficient in 1982. It should be noted that most of the highway miles in the state are not subject to the HPMS. The June 1983 issue of Constructor indicated that Missouri would be ranked as average in terms of miles of deteriorated road compared with other states. Pavement in poor condition is expected to rise in Missouri since needs are being identified at a rate faster than the highway department is resurfacing.

The cost of improving highways in Missouri is $17.8 billion. This includes $13.4 billion for highways subject to the HPMS ($12.8 billion for structural changes and improvements and $0.6 billion for resurfacing). The cost of improving and reconstructing non-HPMS highways and roads is estimated to be $4.4 billion.

2. *Bridges.* In Missouri, there are 23,833 bridges of which 9,270 are on the state highway system while the remaining are on city streets and county roads. Using the Federal Highway Administration guidelines, 5,447 bridges fall into the functionally obsolete category. A 1981 comparative study by the Department of Transportation found that over half of the substandard bridges in the U.S. are located in 10 states. Missouri is not only among the ten, but only three states have a larger percentage of deficient or substandard bridges. The cost of rehabilitation or replacement for Missouri bridges is $1,185.5 million in 1982 dollars.

3. *Mass transit.* Urbanized public transit systems (UPTS) exist in all five of the SMSA's in the state. The largest is the Bi-State system of St. Louis followed by the Kansas City Area Transit Authority, then Springfield, St. Joseph and Columbia. Public transit capital outlays are 80 percent financed from federal sources. Over the 1978 to 1980 period, capital outlays have ranged from a low of $5 million to a high of $44 million.

The Urban Mass Transportation Administration projected capital improvements over the 1983 to 1987 period to be $114.5 million. A significant impact on capital outlays could be the initiation of fixed rail systems in St. Louis and Kansas City which have been proposed at a cost of $500 million. Total estimated capital needs for the entire 1982 to 2000 period are projected to be $914 million.

4. *Airports.* Total capital outlays for public airports from 1978 to 1982 amounted to nearly $104 million. Federal assistance represented 70 percent of the total, 29 percent came from local governments, and one percent came from the state. Extrapolating from past capital outlays, airport needs are projected to be $433 million over the 1982 to 2000 period.

5. *Ports.* There are 10 port authorities along the Mississippi and Missouri Rivers. Historically, little operational or capital spending support has come from the state. A port development plan was updated in 1982 which estimated port development needs to be $70 million during the short-term (1983 to 1987) and $287 million over the long-term (1987 to 2000), for a total needs estimate of $357 million. Revenue

sources are difficult to project. The maximum level of support from the state for the short-term needs would be $15.75 million.

B. Water Supply, Distribution and Treatment

There are about 1,000 municipalities and special water districts in Missouri. At present, no state agency collects statewide data on water treatment, storage, and transmission and distribution facilities. Over the 1971 to 1981 period, per capita capital expenditures averaged about $3.85. Total per capita expenditures averaged about $12.45. With a projected 5,689,000 Missouri residents in 2000, future capital outlays in 1982 dollars are projected to be $613.3 million. Backlog requirements are based on recent national surveys of backlog investment requirements and assuming a share of the national figure proportional to Missouri's share of the total water supply expenditures in the U.S., a total backlog figure of $1,078 million to $1,726 million is derived. Using the smaller of the two figures and the capital outlay figure of $613.3 million, a total capital expenditure requirement of $1,691.3 million is developed. Revenues are projected to be $613 million.

C. Wastewater Collection and Treatment

Missouri had a total wastewater treatment capital outlay of $159.3 million in 1977 of which 70 percent came from the federal treasury. The drop off of federal funding combined with the poor fiscal condition of state and local governments explain the drop in capital expenditures after 1977. Based on the 1982 EPA needs survey, backlog needs are estimated to be $2,316 million, new assessed needs over the 1982 to 2000 period are calculated to be $765.8 million. Thus, total needs are estimated to be $3,082.2 million. On a per capita basis, Missouri's backlog needs are 27 percent greater than the national average and the state's year 2000 needs are 70 percent greater than the national average.

III. SUMMARY AND CONCLUSIONS

The table below summarizes the estimated cost of and revenue for capital requirements in the state of Missouri.

ESTIMATED CAPITAL REQUIREMENTS, COST AND REVENUE, STATE OF MISSOURI, 1982 TO 2000

[In millions of dollars]

Infrastructure	Backlog and projected needs	Revenue	Gap
Highways and streets	17,773	7,290	10,483
Bridges	2,115	1,800	315
Mass transit	914	270	644
Airports	433	360	73
Ports	357	n/a	n/a
Water supply	1,691	613	1,078
Wastewater treatment	3,082	1,379	1,703
Total	26,365	11,712	14,296

Interestingly, over the shorter 1982 to 1987 time horizon, the financing gap is more pronounced. During this period, capital needs are estimated to be $23.3 billion, revenues or the anticipated actual capital coutlay is projected to be $3.8 billion, for a gap of $19.5 billion. Part of this disparity reflects the inclusion of backlog requirements in the short-term projections.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF MISSOURI

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$208	$33	$15	$256	$496	$510	$601	$105	$43	$478	$1,381	$1,423
1970	262	44	15	321	577	592	690	127	41	858	1,486	1,527
1971	277	44	21	342	657	678	668	114	53	835	1,567	1,619
1972	264	22	26	313	666	692	612	53	62	727	1,501	1,563
1973	225	26	24	275	574	598	488	57	53	598	1,214	1,267
1974	302	23	17	342	583	599	512	43	32	587	1,046	1,078
1975	282	49	16	347	624	640	445	83	26	553	1,026	1,052
1976	299	80	17	396	683	701	476	127	27	630	1,092	1,119
1977	307	90	22	419	700	722	470	134	33	637	1,058	1,091
1978	269	98	21	387	627	647	346	133	27	507	846	874
1979	389	87	27	503	787	814	421	106	33	560	935	968
1980	421	143	33	597	1,019	1,052	398	160	37	596	1,086	1,123
1981	376	202	38	617	1,066	1,104	359	213	40	611	1,083	1,123

Fiscal year	Poplation (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	4,654	129.08	22.53	9.17	160.78	296.63	305.80	0.42	0.07	0.03	0.53	1.00
1970	4,678	147.44	27.16	8.85	183.45	317.57	326.42	.45	.08	.03	56	1.00
1971	4,702	142.00	24.32	11.23	177.55	333.18	344.41	.41	.07	.03	.52	1.00
1972	4,726	129.46	11.11	13.16	153.74	317.56	330.72	.39	.03	.04	.46	1.00
1973	4,750	102.65	11.99	11.22	125.86	255.53	266.75	.38	.04	.04	.47	1.00
1974	4,774	107.32	9.07	6.63	123.02	219.14	225.76	.48	.04	.03	.54	1.00
1975	4,798	92.78	17.23	5.33	115.35	213.92	219.26	.42	.08	.02	.53	1.00
1976	4,821	98.73	26.34	5.57	130.63	226.55	232.12	.43	.11	.02	.56	1.00
1977	4,845	96.97	27.73	6.82	131.52	218.25	225.25	.43	.12	.03	.58	1.00
1978	4,869	71.15	27.33	5.62	104.10	173.82	179.44	.40	.15	.03	.58	1.00
1979	4,893	86.09	21.59	6.72	114.40	191.01	197.73	.44	.11	.03	.58	1.00
1980	4,917	81.02	32.62	7.47	121.11	220.90	228.37	.35	.14	.03	.53	1.00
1981	4,941	72.61	43.08	8.02	123.71	219.27	227.29	.32	.19	.04	.54	1.00

MONTANA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Context

Montana is a large and sparsely populated state, ranking fourth among states in area but 43rd in population. Between 1970 and 1980, the state's population increased 11.6 percent, 40 percent greater than the national rate, but 40 percent less than that of the Rocky Mountain region. During the previous decade, however, the state suffered from economic stagnation and outmigration. Even now, the state is well acquainted with problems associated with economic decline, as growth is limited to a few selected areas within the state. Given uneven levels of growth, the state will have difficult choices to face regarding the type and placement of investment—whether it should be geared to ease the pains of new growth or to revive economies of stagnant localities.

The Montana economy is based on resource extraction rather than manufacture of goods for final consumption. Mining, wood products and agriculture have provided the foundation for Montana's economic development.

A resource-based economy is subject to great fluctuations. Agricultural output is sensitive to changes in climate and price but generally the state's output of its major products—wheat, cattle and barley—has been increasing. The long term outlook for the agricultural industry is generally positive. The wood products industry depends on housing construction which is sensitive to national business cycles and has been hurt by the recession. Future projections show that levels of harvest should remain constant. The mining industry is also cyclically sensitive but in addition is subject to larger boom-bust cycles. Copper production, smelting and refining have played an especially important role. In recent years Montana producers have not been competitive on the world market and shutdowns have resulted in substantial joblessness and dislocation. On the positive side, production of energy minerals has been increasing. Coal is most important but the state also has significant oil and gas reserves.

Dependence on a natural resource economy has several implications for infrastructure development. Boom-bust cycles make it difficult to plan optimal levels of infrastructure development. Rapid growth also places a heavy burden on the institutional capabilities of the state. Resource industries are especially dependent on infrastructure—particularly transportation—to remain competitive. The cost of providing the needed infrastructure is relatively high because resource industries tend to be dispersed in remote locations and the heavy loads involved lead to rapid deterioration of highways, bridges and rail crossings.

B. Capital Planning and Finance

1. *Planning.* The state government has indicated a high level of concern about all of its infrastructure and has engaged in sophisticated planning, particularly in those functional areas where the state has operational responsibility. In the transportation area, for example, the state highway department recently completed an 18-month needs analysis of the federal-aid road system which estimated investments required to upgrade roads to alternative standards.

Levels of information regarding local infrastructure and financing are low, although efforts are now underway at the state level to develop a data base.

2. *Finance.* Montana may incur debts if authorized by a two thirds vote of the legislature or by referendum. Outstanding direct state debt as of 1982 was $74.22 million. Additional bonds have been authorized but not issued in water development. The state is also authorized to issue industrial development bonds to finance facilities for railroads, air transportation and water storage. Issuance of such bonds is under consideration.

At the local level, water and sewerage is often provided via special improvement districts and debt financing is typically involved. Little is known about the condition of local infrastructure, future levels of need or the fiscal position of local governments.

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[1] Based on Jim Ohi and Frank Cesario, "Montana Infrastruture", (Denver: Colo. Graduate School of Public Affairs, September 1983)

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* Montana has 78,152 miles of road. The state is responsible for the 11,704 miles comprising the federal aid system. The remaining 85 percent of roads are under local jurisdiction and little is known about their current condition or investment requirements.

Using a rating system that consider structural adequacy, safety and hourly volume, the state highway department has assessed the adequacy of the federal-aid system. While the interstate system is judged to be in reasonably good condition, nearly half of the primary highway miles were rated deficient and will need reconstruction or repair within ten years. The condition of secondary roads is also poor. Only half are paved and of those that are paved, half are 25 years old or older.

Alternative investment plans have been prepared by the state department of highways. The first is designed to bring the federal-aid system into conformance with current design standards over a 10-year period and would cost $3.78 billion. The second is based on a modification of design standards to achieve a "reasonable level of service." This would cost $1.77 billion over 10 years.

There are 2,272 bridges on the federal aid system, and according to federal standards, 51 percent are structurally deficient or functionally obsolete. It would cost $155 million to replace or rehabilitate all of the bridges which fall below standard. If only replacement needs are considered, required, investment would be $87.2 million. There are 2,136 bridges on roads not on the federal-aid system. Of these 958 qualify for replacement and 656 for rehabilitation. To replace deficient bridges would cost $95.8 million. No estimate was provided of rehabilitation costs.

Translated into this study's time frame and using the state's needs analysis based on a "modified level of service", it appears that $3,186 million should be spent through 2000 on the state highway system. Assuming a constant level of state spending and a federal obligation ceiling of $80 million per year, available revenues are likely to total $1,599 million or half the amount required to meet investment needs.

2. *Railroads.* There are approximately 5,126 miles of operating track in Montana, mostly used for hauling freight. Coal is the dominant commodity shipped by rail.

The concern in Montana is that lesser used branch lines are unprofitable to operate and may be abandoned. Yet, it is these branch lines that provide farmers with direct access to rail shipment. If forced to ship grain by truck to mainlines, it will be more difficult for Montana's farmers to compete with other grain producers in the international market. The state estimates that $35 million is needed over the next 20 years to bring Montana's branch line systems into a relatively stable financial status. Funding for rail line rehabilitation has come from the federal government in a program scheduled for elimination. The state, however, has $6.2 million left from its grant that can be applied toward meeting investment needs.

3. *Airports.* There are 116 public use airports in Montana, eight of which receive air carrier service by major airlines. The state aeronautics division, which has regulatory responsibility, considers Montana's aviation system to be generally good condition.

Needs over the next 20 years include installation of navigational aids and new or enlarged airports in as many as 15 communities. An additional nine airports have serious physical problems caused by a lack of preventive maintenance that must be corrected within five years if they are to continue to serve the public.

The state estimates that approximately $55 million will be needed over the period 1982–2000 to meet needs.

Revenues for airports derive from the federal airport development and assistance program, a state tax of .01 per gallon on aviation fuel (which supports the state aeronautics division and a 50–50 cost-sharing program to provide safety equipment at local airports) and local property tax and airport revenues. If the state's projection of revenues for 1982–1986 is extrapolated through this report's time frame, it appears total revenues will equal $66 million. At the state's general aviation airports, however, revenues will fall short of needs by $1.13 million annually, while air carrier airports will show a surplus of $1.24 million annually.

B. Water Supply

Water is relatively plentiful in Montana and there are no shortages of supply for present municipal or industrial needs. Agriculture, however, consumes about 96 percent of water used in Montana and some irrigators have experienced shortages.

The state owns 25 water shortage facilities and there is a need for structural repairs. Costs are unknown for eight of 10 dams identified as needed rehabilitation.

Until recently, very little was known about the water system needs of local governments. A working group of state and federal officials developed a survey to develop information on this area. Based on 94 responses, 26 needed water projects costing $86 million were identified. More than half the projects and 41 percent of estimated costs are for improvements to distribution systems. Supply and treatment projects account for another 22 percent each of the total investment requirement.

In 1981, the Legislature enacted a water development program to be financed by a percentage (0.625 percent) of gross coal severance tax revenues. This tax should provide about $750,000 per year. The state is also authorized to issue bonds for water development purposes.

C. Wastewater Treatment

According to the state agency which has assumed full responsibility for administering the federal construction grants program, existing wastewater treatment facilities in Montana are generally adequate. Some of the smaller systems needed to be upgraded. For the most part, wastewater treatment systems are either in good condition or targeted to receive funds in the next few years. The state estimates that the cost of meeting needs will be about $114.7 million. If Montana continues to receive the same amount from EPA as authorized in fiscal year 1984 and 1985—or $12 million per year—then the state should be able to meet its needs.

III. SUMMARY

Montana reports a total investment need through 2000 of $3,447 million. This is a conservative estimate inasmuch as it entirely excludes local roads and reflects incomplete information on local water supply systems. Montana's biggest concern is its road system which is deteriorating faster than it is being repaired or maintained. Local water systems represent a second area of concern. Many systems are believed to be in poor condition and often the local jurisdictions with the biggest investment needs have the least fiscal capability.

MONTANA: ESTIMATED INVESTMENT REQUIREMENTS, AVAILABLE REVENUES AND FUNDING SHORTFALL BY FUNCTION, 1983–2000

[In millions of 1982 dollars]

	Needs	Revenues	Gap
Total	3,477	1,800	1,672
Highways and bridges	[1] 3,186	1,599	(1,582)
Mass transit	NA	NA	NA
Air transportation	55	[2] 66	11
Railroads	35	6	(29)
Water supply, storage, treatment, and distribution	[3] 86	[4] 14	(72)
Wastewater collection and treatment	115	115	0

[1] Excludes all investments required for local roads and cyclical maintenance costs on secondary and urban roads. Needs estimate based on "modified standards."

[2] Federal ADAP funds only. Surplus is expected at air carrier airports, but at general aviation airports, revenues will fall short of needs.

[3] Based on incomplete survey return from local governments. Also excludes cost of rehabilitation required at State-owned water storage facilities.

[4] State earmarked tax revenues only.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF MONTANA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Higways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$73	$4	$2	$79	$110	$111	$212	$13	$4	$230	$305	$310
1970	92	4	2	98	133	135	242	11	5	259	344	349
1971	103	3	2	108	142	145	248	8	6	261	339	345
1972	109	1	3	113	152	155	252	3	8	262	342	350
1973	97	16	4	117	174	178	211	35	9	255	369	377
1974	72	10	4	86	138	141	122	20	7	149	247	254
1975	75	13	8	95	159	167	118	21	13	152	261	274
1976	103	8	18	130	189	207	164	13	28	205	302	330
1977	130	6	15	151	225	240	199	9	22	230	340	362
1978	113	8	4	126	220	225	146	11	6	163	298	303
1979	110	9	5	124	242	248	119	11	6	136	288	294
1980	145	5	10	159	270	280	137	6	11	153	288	299
1981	171	9	10	190	283	293	163	9	11	183	287	298

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	685	310.08	18.85	6.40	335.33	445.98	452.39	0.69	0.04	0.01	0.74	1.00
1970	694	349.34	16.34	7.56	373.24	495.16	502.71	.69	.03	.02	.74	1.00
1971	703	352.33	11.53	7.94	371.80	482.60	490.54	.72	.02	.02	.76	1.00
1972	713	353.30	4.30	10.66	368.26	480.47	491.13	.72	.01	.02	.75	1.00
1973	722	291.98	48.55	12.35	352.88	510.53	522.88	.56	.09	.02	.67	1.00
1974	731	166.93	26.75	9.44	203.12	337.47	346.91	.48	.08	.03	.59	1.00
1975	741	159.76	28.54	16.94	205.24	352.82	369.77	.43	.08	.05	.56	1.00
1976	750	219.04	17.19	37.44	273.68	403.16	440.61	.50	.04	.08	.62	1.00
1977	759	262.24	12.42	28.36	303.02	448.18	476.54	.55	.03	.06	.64	1.00
1978	768	190.02	14.20	7.47	211.69	387.37	394.83	.48	.04	.02	.54	1.00
1979	778	152.46	13.90	8.30	174.65	370.35	378.64	.40	.04	.02	.46	1.00
1980	787	173.70	7.26	13.87	194.83	365.93	379.80	.46	.02	.04	.51	1.00
1981	796	204.47	11.50	13.38	229.35	360.52	373.90	.55	.03	.04	.61	1.00

NEW JERSEY[1]

Profile of State Infrastructure Requirements

I. CONTEXT

New Jersey is a highly urbanized state in the nation's "frostbelt." Weather conditions and an aging infrastructure—some of which date back to pre-Civil War years—along with the requirements for meeting growth provide New Jersey with serious problems related to the development of new and the maintenance and replacement of declining infrastructure.

Population and economic context. The context in which infrastructure issues are being addressed includes:

Highly urbanized state—Seventeen of the state's 21 counties and 91 percent of the state's population were within SMSA boundaries in 1980. At 986 persons per square mile, the state ranks first in terms of population density in the country and far exceeds the national figure of 64 persons per square mile.

Population growth—New Jersey is expected to see its population increase at an annual rate of about 1.1 percent between 1980 and 2000. However, this moderate rate of growth (consistent with national projections) conceals a considerable growth differential within the state. The state is thus confronted with simultaneous problems of managing growth and decline.

Shift in economic focus—The economy has witnessed a movement toward greater emphasis in service employment with a decline in the share of manufacturing employment.

Income—New Jersey per capita income of $10,924 in 1980 ranked fourth in the nation.

Intergovernmental revenue—Per capita federal expenditures for highways and sewers amounted to $37 in 1979, well below the national average of $51 per capita. Only Michigan, Texas, and California ranked lower.

The capital planning process. New Jersey has had a long-standing commitment to systematizing the capital planning process. In 1975, the Governor's Commission to Evaluate the Capital Needs of New Jersey (the MaNaughton Commission) issued its findings and recommendations for capital investment in environmental resources, transportation, housing, public institutions, and other infrastructure components. It also recommended the creation of a permanent New Jersey Commission on Capital Budgeting, which was also established in 1975.

The New Jersey Commission on Capital Budgeting and Planning serves in an advisory capacity to the governor and legislature and prepares the annual Capital Improvement Plan (CIP) for the state. A principal focus of the CIP is to establish priority investment projects which are to be recommended to the governor for budget preparation and legislature for subsequent appropriation. This very process provides New Jersey with a strong historical data base and better coordinated capital investment planning than found in most states. The long-range planning documents provide detailed estimates of infrastructure needs through fiscal year 1985, less detailed estimates through 1989, and the basis for projections through 2000.

A potential innovation for the funding of capital investment is the proposed New Jersey Infrastructure Bank. This proposal would establish a revolving loan mechanism for funding local capital needs including water supply, wastewater treatment, transportation and resource recovery. The proposal has received criticism for adding yet another level of government between federal funding sources and local governments, but would also provide the basis for further systematizing and rationalizing capital investment planning and budgeting.

II. HISTORICAL CAPITAL INVESTMENT

Capital spending within the New Jersey-New York region has mirrored national investment trends. Throughout the 1960s the region invested an average of $2 billion a year in capital improvements. Investment peaked in 1972 with an investment of more than $4 billion, an amount equal to three percent of the gross regional product and nine percent of all public capital outlays nationally. By the end of the 1970s, real investment was less than it was 20 years earlier. On a per capita basis, investment remained relatively stable at approximately $150 per capita between 1957 and 1977. This investment rate fell to $75 per person in 1980—well below the national average of $110 per capita. The combination of a declining rate of investment and accelerating depreciation of the aging capital stock has led to a negative capital formation in the region.

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[1] Based on Robert W. Lake, "New Jersey's Infrastructure Needs: A Case Study," (Center for Urban Policy Research, Rutgers University, New Brunswick, New Jersey: September 1983).

III. FUNCTIONAL DESCRIPTIONS

Investment needs have been calculated based on a variety of state studies which identify current and projected capital investment requirements. Generally, these studies have determined investment requirements for a specified period. These total investment figures have then been converted into annual average investment requirements which can subsequently be compared with annual revenue projections for the state.

A. Transportation

Transportation components addressed in the New Jersey study included highways and bridges, railroads, mass transit and airports.

1. *Highways and bridges.* New Jersey has 33,396 miles of streets and highways and 5,786 bridges. Only 16 percent of the state's roads are rated as good or very good while 40 percent are rated as poor or very poor. Similarly, 16 percent of the state's bridges are rated as either fair or poor. The State Department of Transportation has identified a current backlog of need maintenance and rehabilitation of the state's roads and bridges amounting to $1.5 billion. Between 1983 and 1989, investment needs are projected to be $7.0 billion, or $995 million annually.

2. *Railroads.* New Jersey involvement in rail operations pertains to the acquisition, rehabilitation, and maintenance of real lines, abandoned by Conrail, deemed critical to the state's economic well-being. Needs are projected to be $26.9 million over the 1983–1990 period, or $3.4 million per year.

3. *Mass Transit.* New Jersey has an extensive public transportation system under the jurisdiction of the New Jersey Transit Corporation. The system encompasses a 490 route-mile commuter rail network and nearly 14,500 route miles within the commuter bus system. Little expansion of this system is envisioned, however there is needed investment for upgrading and maintaining the system. Total investment need over the 1983 to 1988 period is $1.8 billion, or $297.8 million annually.

B. Water Supply, Distribution and Treatment

The water system in the state is characterized by complexity. The water supply system involves public water departments, private water companies, water authorities, and state-operated utilities. Parts of the system are well over 100 years old. The New Jersey Department of Environmental Protection (DEP) in its Water Supply Master Plan identifies a variety of needs in the areas of declining water quality, inadequate interconnections between systems, and rehabilitation of distribution systems. Total investment needs over the 1981 period are $836 million, or $167.2 million annually.

C. Wastewater Collection and Treatment

Similar to the state's water supply, the wastewater disposal system is a complex, extensively decentralized network of municipal and regional facilities. Also, similar to the water supply situation, many of the facilities date back to the Civil War period. A needs survey conducted in 1982 by the EPA and the State Division of Water Resources identified current and projected needs to 2000. The total investment need is for $6.2 billion, or an average of $327.1 million per year.

IV. REVENUE PROJECTIONS

Revenues for capital investment come from a variety of federal, state and local sources. Assumptions incorporated into the estimates of future revenues for New Jersey infrastructure include:

One percent of the state general fund revenues being spent on capital projects;

The infrastructure elements included in this analysis account for 60 percent of the total capital spending;

There will be $200 million in general obligation bonds per year, of which 50 percent are allocated to the infrastructure elements covered in this analysis;

Seven percent of local government outlays will be for capital spending, of which 60 percent are for the infrastructure elements covered in this analysis.

Projected revenues for infrastructure are projected on an annualized basis to total $962 million.

V. SUMMARY AND CONCLUSIONS

The revenue shortfall is determined by subtracting the anticipated transportation, water and sewer infrastructure requirements from the projected revenue.

NEW JERSEY: ESTIMATED NEEDS, AVAILABLE REVENUES: 1983–2000

[In millions of 1982 dollars]

	Needs	Revenues	Shortfall
Highways	17,914	8,485	9,429
Other Transportation	5,573	3,290	2,283
Sewer	5,888	3,636	2,252
Water	3,010	1,905	1,105
Total	32,385	17,316	15,069

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 to 1981, FOR THE STATE OF NEW JERSEY

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$405	$71	$32	$508	$832	$864	$1,170	$222	$95	$1,487	$2,317	$2,411
1970	401	64	15	480	899	914	1,054	186	41	1,281	2,316	2,357
1971	434	69	14	518	1,008	1,022	1,047	181	36	1,264	2,403	2,439
1972	467	101	24	591	998	1,022	1,079	237	57	1,374	2,249	2,306
1973	460	77	13	550	1,014	1,027	999	169	28	1,196	2,144	2,172
1974	462	85	23	570	1,151	1,174	784	161	44	988	2,066	2,110
1975	347	98	25	470	1,083	1,108	548	165	41	753	1,782	1,823
1976	293	140	33	466	1,082	1,115	466	223	51	741	1,729	1,780
1977	208	191	49	447	1,057	1,106	318	285	72	675	1,596	1,668
1978	210	193	35	437	935	969	270	263	46	579	1,262	1,308
1979	307	312	32	650	1,296	1,328	332	378	39	749	1,540	1,579
1980	350	287	39	675	1,369	1,408	331	321	43	696	1,460	1,503
1981	337	338	59	734	1,712	1,771	321	356	61	738	1,739	1,800

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	7,152	163.64	31.08	13.25	207.97	323.94	337.18	0.49	0.09	0.04	0.62	1
1970	7,171	147.04	25.91	5.74	178.69	322.91	328.64	.45	.08	.02	.54	1
1971	7,190	145.62	25.18	4.98	175.79	334.24	339.22	.43	.07	.01	52	1
1972	7,210	149.73	32.93	7.90	190.56	311.95	319.85	.47	.10	.02	.60	1
1973	7,229	138.22	23.36	3.89	165.47	296.62	300.51	.46	.08	.01	.55	1
1974	7,248	108.15	22.17	6.06	136.37	285.08	291.13	.37	.08	.02	.47	1
1975	7,268	75.34	22.68	5.63	103.64	245.22	250.85	.30	.09	.02	.41	1
1976	7,287	63.95	30.66	7.03	101.64	237.28	244.31	.26	.13	.03	.42	1
1977	7.306	43.52	39.03	9.85	92.40	218.50	228.35	.19	.17	.04	.40	1
1978	7.325	36.92	35.89	6.28	79.10	172.28	178.57	.21	.20	.04	.44	1
1979	7.345	45.16	51.51	5.34	102.01	209.64	214.98	.21	.24	.02	.47	1
1980	7.364	44.96	43.61	5.88	94.45	198.20	204.08	.22	.21	.03	.46	1
1981	7.383	43.52	48.17	8.25	99.94	235.58	243.84	.18	.20	.03	.41	1

NEW MEXICO[1]

Profile of State Infrastructure Requirements

I. CONTEXT

New Mexico ranks as the fifth largest state in area among the 50 states. It is a semi-arid state, rich in history, but also a state which has recently faced many of the growth pressures associated with energy and mineral development.

Population and economic context. Since the early 1970s, New Mexico has been counted among the fastest-growing states in the United States, yet the state remains sparsely populated. In 1980, the state's population density was 10.7 persons per square mile compared with the national average of 57.4 persons per square mile. Between 1970 and 1980, the population grew by 28 percent, or almost three percent per year. Even so, more than one-third of the state's 32 counties recorded net outmigration over the 10-year period. This was more than offset by the strong net immigration in other counties, particularly metropolitan areas and those counties with energy resources.

New Mexico's economy differs from the national economy as a whole in that it has significantly more government and mining and much less manufacturing than the average state. Per capita income trails the national figure, although the gap between the two has been closing in recent years. In 1981, per capita income figures for New Mexico and the U.S. were $8,654 and $10,491 respectively.

The growth trends recorded in New Mexico may have reversed in the last few years largely due to the national recession and to specific national and international market conditions affecting the minerals and energy industries notably uranium, cooper, and oil and gas.

Population growth between 1980 and 2000 in New Mexico is expectd to continue to outpace the national rates. Growth rates between 1980 and 1990 and the subsequent 1990 to 2000 period are anticipated to be 26 percent and 18 percent respectively. National growth rates will be about half these figures.

The capital planning process. An unusual aspect of the New Mexico capital planning process is the state's Severance Tax Permanent Fund. It was established in 1973 to receive special severance taxes leived on the extraction of the state natural resources. The principal of the fund is to remain untouched and will serve as a source of income to be devoted to the capital needs of government for future generations after the state's natural resources are depleted. The legislature may issue bonds which are paid from the income of the fund. To date, most of the bonds so issued have been for capital improvements.

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

Transportation components addressed in the New Mexico study included highways and bridges, railroads, mass transit and airports.

1. *Highways, roads, and streets.* There are more than 70,000 miles of streets and highways in New Mexico with more than 80 percent being classified as being locally maintained. In 1980, $245 million was spent by state, county and municipal governments on the New Mexico highways, roads and streets. Expenditure patterns varied by level of government with local governments spending principally on maintenance while the majority of state expenditures were for capital outlays. Revenues at the local level come primarily from highway user taxes and general fund appropriations. Federal funds accounted for more than a third of the state highways revenues in most years. The enactment of the $0.05 per gallon increase in gasoline taxes and the formula developed to share monies with the states suggests continued strong federal involvement.

The New Mexico State Highway Department evaluated highway needs in the state and found that 33 percent of the system is inadequate for the needs and demands of today's traffic. After adjusting for a longer time frame in the Highway Department's analysis and accounting for inflation, the state's highway needs are estimated to be $3,937 million in 1982 dollars. Assuming that 50 percent of these expenditures (consistent with historical trends) will be for capital requirements, some $2 billion will be required to meet capital needs between now and 2000.

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[1] Based on Lee B. Zink, "Public Infrastructure Needs, 1982-2000: New Mexico Case Study," (Institute for Applied Research Services, The University of New Mexico, Albuquerque: September 1983).

No projections of needs are available for county roads or municipal streets in consistent form. However, assuming the 1980 expenditure levels to be indicative of the future, some $400 million in 1982 dollars would be expended between 1983 and 2000. Total state and local capital needs are projected to be $2.65 billion.

The New Mexico Highway Department has projected revenues to 1987. Based on these data and assuming some increase in certain revenue sources to offset the anticipated decline in revenue from the motor fuel tax, projected revenues available for capital outlays are $1,682 million. Thus, a capital needs shortfall of $970 million is identified.

2. *Bridges*. New Mexico has 3,611 bridges. Of the 3,074 which are on interstate, national or state highways, 580 or 18.8 percent are judged to be substandard. Of the 537 county or municipally controlled bridges, 214 or 39.8 percent are substandard. In both instances, the state figures are below national percentages.

The substandard classification includes those bridges which are either structurally deficient or functionally obsolete. New Mexico's substandard bridges are approximately 60 percent functionally obsolete and 40 percent structurally deficient. A "commonly" accepted figure for the costs of bridges and approach roads over the next 20 years is $250 million in 1982 dollars. Funds are anticipated to be available to finance these improvements.

3. *Railroads*. The only possible railroad capital expenditures which may materialize in the state over the next 20 years will arise from needs to foster the state's economy. The 1983 legislature considered and rejected proposals to fund two rail lines from the state's Severance Tax Permanent Fund.

4. *Mass transit*. Albuquerque is the only city in New Mexico served by public transportation (buses). A June 1983 five-year plan prepared by the Albuquerque Transit Department indicates $5 million in needs for a variety of facilities ranging from storage facilities to park-and-ride lots. These costs combined with costs of $20 million for bus replacement over the next 20 years indicates total needs of $25 million. Buses have in recent years been purchased almost exclusively with federal monies. Should these funds not be available, the city would have to finance the transit needs.

5. *Airports*. New Mexico has 63 airports, but only the Albuquerque and Roswell airports are classified as general transport. The Aviation Division of the State Department of Transportation issued its report of the New Mexico Airport System Plan in March 1983 which estimates airport infrastructure needs through 2000. The report indicates that while most New Mexico cities have established various user fees, few cities or counties in the state were making use of all available sources of local funds to support airport improvement.

The interdependency of maintenance and capital improvements is apparent in the present neglected maintenance procedures in New Mexico. State and federal funds are available for reconstruction, but not for maintenance. Therefore, at many airports, pavement surface maintenance is postponed to the point that complete reconstruction is necessary. Thus, operating costs are shifted into the capital category making operating budgets artificially low. The State Aviation Fund and the Federal Airport Improvement Program will remain the two principal funding sources for capital improvements projects through fiscal year 1987 when the federal program legislation expires.

The airport capital needs through 2000 are projected to be $196 million. Assuming a continuation of federal and state funding at the projected 1987 level, revenue is projected to be $165 million leaving a gap of $31 million.

B. Water Supply, Distribution and Treatment

Average statewide precipitation in New Mexico is 13 inches annually. Water availability is a key determinant of future ecomonic and population growth in the state. Water for New Mexicans is available from two sources: surface water and underground water. The state receives five million acre feet of water annually from precipitation and stream flow from other states. Maximum consumption, however, is three million acre feet per year. Approximately three billion acre feet of recoverable fresh water is estimated to be underground with more than four-fifths in the Rio Grande Basin. With the forecast population growth for New Mexico, some reallocation of water uses are anticipated. Water use will likely move from irrigated agriculture to urban, industrial, minerals and other high value users over the next 20 years. Two aggravating water problems faced by New Mexico are the depletion of the Ogallala Aquifer in the eastern portion of the state and the so-far successful lawsuit of the city of El Paso which compels New Mexico to export water to the city. A major project which is underway is the Brantley Dam which is estimated to cost

$272 million. In addition, there are three major water projects which are in the planning stages and will cost an estimated $1.0 billion. There are 613 community water supply systems in New Mexico of which 381 are publicly owned. Total revenues are projected to be sufficient to meet future capital needs related to water supply, delivery and treatment.

C. Wastewater Collection and Treatment

Since 1970, the state has provided over $26,800,000 to 56 municipalities in matching funds while federal sources provided $156 million for wastewater treatment projects. Federal monies come from the Clean Water Act and state monies are appropriated to the Water Quality Control Commission under provisions of the New Mexico Water Quality Act. Total project costs have been shared 75 percent by the federal government, 12.5 percent by the state, and 12.5 percent by the local governments. Another funding source for wastewater infrastructure is the Community Assistance Act passed in 1977 to aid areas of the state impacted by energy and mineral development. Some $5,600,000 from this source has been spent on wastewater projects from 1977 to 1981.

The 1982 EPA Needs Survey indicates that in 1982 at least $121 million will be needed to meet federal standards. By 2000, an additional $251 million will be required. An estimate developed by the New Mexico Water Quality Control Commission was $105 million for current needs. Overall state needs for the 1982 to 2000 period total $356 million. Traditionally, the federal government has borne 75 percent of such capital costs; therefore, $267 million in 1982 dollars will be required to meet the identified wastewater treatment capital needs.

III. SUMMARY AND CONCLUSIONS

The projected capital needs and anticipated available revenues for specific infrastructure components are summarized below:

SUMMARY OF CAPITAL NEEDS AND AVAILABLE REVENUES, STATE OF NEW MEXICO, 1983 TO 2000

[In millions of 1982 dollars]

Infrastructure component	Capital needs	Available revenues	Gap
Highways and bridges	2,650	1,680	970
Railroads	0	0	0
Mass transit	200	25	175
Airports	196	165	31
Water supply	1,214	1,214	0
Wastewater	356	89	267
Total	4,616	3,173	1,443

The largest needs category is highways, roads, streets and bridges which will require an estimated additional billion dollars by 2000. A substantial amount of money will be spent on enhancing the state's water supply; however, the money is presently committed. Wastewater is a significant concern for New Mexico municipalities and will require about $267 million more than will be available. Total identified needs are $4,616 million with corresponding revenues projected to be $3,173 million leaving a gap of $1,443 million.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF NEW MEXICO

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$63	$5	$8	$75	$118	$125	$183	$14	$22	$219	$328	$350
1970	74	7	8	89	132	140	195	20	22	237	340	362
1971	70	5	3	78	135	138	169	14	7	189	322	329
1972	81	4	5	90	152	157	187	9	12	208	343	355
1973	58	8	8	74	138	146	126	18	18	162	292	310
1974	70	9	12	90	154	165	118	17	23	157	276	298
1975	86	21	25	131	224	249	135	35	40	211	368	408
1976	96	11	10	117	241	251	153	17	15	186	385	401
1977	73	12	10	96	215	225	112	18	15	145	324	339
1978	94	11	15	120	236	251	121	16	20	156	319	338
1979	152	24	26	203	354	380	165	29	32	226	420	452
1980	160	17	40	217	398	437	152	19	44	215	424	468
1981	146	33	23	202	405	428	139	35	24	198	412	435

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	989	185.19	14.33	22.47	221.99	331.40	353.87	0.52	0.04	0.06	0.63	1.00
1970	1,017	191.85	20.01	21.44	233.31	334.35	355.79	.54	.06	.06	.66	1.00
1971	1,045	161.65	13.02	6.32	180.98	308.50	314.82	.51	.04	.02	.57	1.00
1972	1,074	173.72	8.55	11.28	193.55	319.12	330.40	.53	.03	.03	.59	1.00
1973	1,102	114.26	16.50	16.18	146.94	264.81	280.99	.41	.06	.06	.52	1.00
1974	1,130	104.55	14.62	20.02	139.19	243.89	263.91	.40	.06	.08	.53	1.00
1975	1,159	116.82	30.35	34.60	181.77	317.97	352.57	.33	.09	.10	.52	1.00
1976	1,187	129.27	14.61	13.00	156.88	324.62	337.62	.38	.04	.04	.46	1.00
1977	1,215	92.44	14.78	12.38	119.60	266.69	279.06	.33	.05	.04	.43	1.00
1978	1,243	97.10	12.50	15.78	125.38	256.22	272.00	.36	.05	.06	.46	1.00
1979	1,272	129.64	22.73	25.27	177.65	330.47	355.75	.36	.06	.07	.50	1.00
1980	1,300	116.65	14.92	33.83	165.40	326.10	359.93	.32	.04	.09	.46	1.00
1981	1,328	104.77	26.31	17.91	148.99	309.93	327.84	.32	.08	.05	.45	1.00

NEW YORK [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Context

New York, with 17.6 million residents in 1980, ranks second in the nation in population. Population declined 3.7 percent between 1970 and 1980 although there is an expectation that this trend will reverse itself.

Population is concentrated in major urban areas, with the 12 SMSAs accounting for 90 percent of the state's population. New York City alone accounts for 40.2 percent of the state population.

New York is considered a relatively wealthy state, with a per capita income in 1981 of $11,440 placing it in tenth rank nationwide. The performance of its economy has been sluggish, however. According to a recent state report its rank of growth in real per capita income—8.8 percent between 1976 and 1980—was substantially below the nation's 39 percent growth rate.

Employment data collected and analyzed by the state suggests some improvement in economic conditions. Between 1972 and 1975, total nonagricultural employment fell from 7.0 million to 6.8 million but it rose to 7.3 million by 1981.

B. The capital planning process

While estimates of need and revenue over 20 year time frame proved difficult to amass, the state has a considerable amount of data on some of its infrastructure inventory. For example, the state has inventoried waste treatment systems since 1927. At the present time there is no formal capital planning process statewide for infrastructure in New York state.

II. HISTORICAL CAPITAL INVESTMENT

According to the U.S. Census, capital investment by all levels of government in New York State declined in 1982 dollars through the decade of the seventies. This was true for most government functions, but was especially severe in the highway function.

The severe fiscal crisis experienced by New York and other cities in the state during the first half of the seventies, in part, explains the trend. First, capital investment was sacrificed in an effort to balance budgets. Later, it was difficult or impossible for several of the cities to obtain funds in capital markets.

During the last several years, expenditures have begun to increase for roads and to stabilize for sewers.

III. FUNCTIONAL DESCRIPTIONS

Investment needs were generally derived from state plans or studies which identify current and projected capital investment requirements over a specified time frame. Where such information was not available, the researcher estimated need by taking information on the extent and condition of existing infrastructure and applying "average" cost figures for replacement or rehabilitation. In all cases, estimates of needs are provided for a five-year period. Estimates through 2000 are given, but heavily qualified.

A. Transportation

All components of the New York transportation system are addressed, although the quantity, quality and time frame of information that was available from secondary sources to analyze needs varies by functional component.

1. *Highways and bridges.* New York ranks third in the nation in vehicle miles of travel. It has an extensive road system consisting of 109,706 miles of pavement. Only a small percentage (15 percent) is state owned. The system is relatively stable in size. The increase in mileage was less than one percent between 1977 and 1982 and most of that was on local roads.

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[1] Based on Rae Zimmerman "Infrastructure Need Analysis for New York State" (Graduate School of Public Administration, New York University, November 1983).

Good information on pavement condition exists for about one-third of the state's roads, those characterized as federally-aided, non-local in function. Condition of local roads was estimated.

The total investment required on federally-aided state roads is $16.0 billion between 1983 and 2000. This figure derives from state administrative records.

The researcher estimated investment needs for local roads by assuming a course of work for road segments broken down by condition categories. An investment of $9.5 billion was estimated to be needed through 2000 for both local and non-local, non-federally-aided roads.

New York's road system includes nearly 20,000 bridges, 7,212 of which are state owned. Almost one quarter of the bridges on the state-maintained system and over half the remainder are judged deficient. Bridges currently judged deficient represent a backlogged need. Additional bridges will fall into the "deficient" category over time. Indeed, based on past experience, the state estimates that bridges fall .122 points per year on the 0 to 7 point rating systems. If this relationship continues, then all bridges not now rated deficient would fall into that category sometime between now and 2000.

To deal with the backlog of deficient bridges, an investment of $8.9 billion is required. To rehabilitate the remainder of the system later in the planning period, another $11.2 billion would be required.

The estimate of the investment required between 1983 and 2000 to maintain or improve its roads and bridges is $45.6 billion based on state data directly or estimates from it.

Likely available revenues were calculated in two ways. First, the state was assumed to be able to spend the same amount in each succeeding year as it has in the recent past, or $1.9 billion annually. If this is the case, revenues will total $34.5 billion over the 1983-2000 period, $11.1 billion short of the investment required. A somewhat more optimistic forecast is obtained if expenditure trends over the last five years are extrapolated into the near term. Using a five-year forecast framework, the researchers estimate that revenues per year may increase to $2.57 billion. If that figure is held constant over the remainder of the forecast period, then $44.5 is estimated to be available, only $1.1 billion shy of the estimated investment requirement. Whichever forecasting method is used, there is a substantial shortfall between 1983-2000.

2. *Mass transit.* Subways and buses play an important role in the overall transportation system of New York state. The New York City area has an extensive subway and commuter rail system and numerous cities rely on fixed route bus systems.

The subway system consists of 710-747 miles of track, 6,500-6,700 cars and almost 500 stations and it serves between 3.5 and 5 million passengers daily. Over the last several years there is clear evidence of declines in subway system performance. For example, the mean distance between subway car failures has been getting shorter and the number of abandonments due to failures has been on the increase. System failures are clearly linked to the age of the system. For planning purposes, the condition of the system is gauged primarily by age, with a lifetime assumed by UMTA of 35 years for cars and 20-30 years for track.

In 1981, there were 8,173 buses being run in the state by 31 systems (including NYC) each operating more than five vehicles per year. In 1983, 56 percent of busses were older than 12 years, which is the general UMTA guideline for replacement.

The major commuter rail systems are the Long Island Railroad and Metro North, both operated by the Metropolitan Transportation Authority. In general, ridership has been increasing but the system is plagued by train delays and a high number of standees.

Relying on a comprehensive 10-year planning document prepared by the Metropolitan Transit Authority, the researcher estimates that New York's investment requirements through 2000 approach $37.3 billion. If bus replacement needs for transit operations outside the MTA system are taken into account, the needs figure is increased marginally to $37.8 billion.

To estimate available resources, the researchers looked at 1982 capital commitments and extrapolated these forward to the projection period. A total of $14.1 billion is estimated to be available for 1983-2000 to finance needs. The researchers also asked the MTA for information on the funding which they have already secured to implement their short term capital improvement program. Over the 1982-1986, funding commitments fall short of estimated needs by $5.3 billion. This picture is slightly more pessimistic than one based in actual levels of past spending, but it is not really inconsistent since additional funding may yet be secured to carry out the short term capital improvement program.

3. *Rail.* The rail system currently consists of over 4,000 route miles used by several carriers but with Conrail being the dominant railroad. Most rail systems cross state lines and little data is collected on a state basis. New York, like many states, is concerned about rail line abandonments and deficits on passenger lines. The state estimates that $250 million should be invested over the next five years to develop an intermodal terminal facility downstate, to improve passenger service upstate and to expand an existing high speed rail line.

In the past, public investment in railroads came from state bonds and federal grants. The bond funds approved by voters are just about used up and continued federal funding is considered unlikely.

4. *Airports.* The researcher drew on capital planning documents prepared by the State Department of Transportation and The Port Authority for an estimate of $589 million in airport investment required over a five-year period. These plans use anticipated federal allotments over the next five years as a framework for the estimate of needs and hence would not include the full range of projects which might be desirable to improve service or expand capacity to meet expected demand.

B. Water Supply, Distribution and Treatment

New York State is served by 12,500 systems providing 3.68 billion gallons of water daily. These systems consist of four components:

a. Storage of supplies—This system includes 1,400 dams of which 161 are used exclusively for water supply reservoirs, wellfields and surface water intake structures. Dams are classified based on the potential damage which would occur in the case of failure. Many of the dams in the "high risk" category are known to have structural problems, but no estimate of the cost repair is available.

b. Transmission from supply to treatment—New York City has identified the need for a third water tunnel to transport its water from upstate reservoirs. Unless this tunnel is built, no inspection or repairs are possible on the two aged tunnels upon which the city now relies.

c. Treatment—The primary problem here is the installation of treatment systems capable of dealing with chemical contaminants.

d. Distribution systems—Many areas require replacement of undersized or corroded water mains. Replacement is required to increase water pressure, reduce leakage and decrease the incidence of water main breaks.

In New York State, with the exception of the third water tunnel (a transmission facility), the largest dollar need is in the distribution component. Distribution lines have been relatively more susceptible to deterioration because of urbanization over many decades, their age and the government's history of paying attention to other parts of the water supply system. A minimum investment of $7.2 billion, or $400 million annually, is required to 2000 on systems covering three quarters of the state's population. This is based on a fairly extensive inventory of proposed investments by these systems.

Using linear modeling techniques, revenues of $855 million were projected for the period of 1983–1987. This implies average annual revenues of $171 million. If this figure is compared with the estimated annual investment requirement, a shortfall of $229 million per year or roughly $4 billion through 2000 seems likely. If the basis for estimating future revenues is actual prior year expenditure, then $203 million would likely be available each year and the shortfall through 2000 would total 3.5 billion.

C. Wastewater Collection and Treatment

New York State has inventoried 535 municipal wastewater treatment facilities (or raw discharge points). Tremendous progress has been made in improving treatment capability. Since 1952, the percentage of systems providing less than secondary treatment has declined from 68 percent to approximately 25 percent. Despite this improvement, EPA has estimated $17.3 billion in investment is required, with the biggest need being the correction of combined sewer overflow.

The researcher noted that several factors made these estimates uncertain. First, EPA is yet to establish a precise definition of secondary treatment. Second, New York might benefit from possible exceptions to the secondary treatment requirement for coastal communities doing ocean discharge. Third, EPA has yet to set toxic substance limits which could influence the type of treatment facility required in a number of communities.

Three revenue estimates were offered for this category of investment need. Using linear modeling techniques for the near term planning period, the researcher suggested that $771 million might be available annually through 2000. Extrapolating to 2000 results in a total revenue estimate of $13.9 billion, $3.4 billion less than the investment required. If 1982 expenditure levels are simply extrapolated through the projection period, a somewhat higher revenue and lower gap estimate result—$14.6 billion in revenues, $2.7 billion deficit. The third revenue estimate is most pessimistic, assuming that the only revenues available would be federal grant funds and the required state-local match. Were this to be true, revenues would total $6.5 billion, leaving a $10.8 billion gap.

IV. SUMMARY AND CONCLUSIONS

New York State is estimated to have investment needs for transportation, water supply and wastewater treatment of $107.4 billion through the turn of the century. On an annual basis, this means capital expenditures of $6.0 billion per year, adjusted as required to meet inflation. Transportation systems account for 77 percent of the total investment requirement, with New York's extensive mass transportation system requiring high levels of capital investment relative to most states.

The estimate of available revenues ranges from $65.6 billion to $76.9 billion. The shortfall would be between $27.7 and $39 billion. The range results because the researcher used two estimating techniques: a linear modeling approach which takes account of recent trends in expenditure levels and a static approach which assumes that future revenues would be the same in constant dollars as they were in 1982.

NEW YORK STATE CAPITAL INVESTMENT NEEDS AND ESTIMATED REVENUES,[1] 1983–2000

[In billions of 1982 dollars]

Infrastructure category	Needs	Revenues [2]	Gap
Highways and bridges	45.6	34.5–44.5	1.1–11.1
Mass transit [3]	37.3	14.1	23.3
Water supply [4]	7.2	3.1–3.7	3.5–4.1
Wastewater treatment and collection	17.3	13.9–14.6	2.7–3.4
Total	107.4	65.6–76.9	30.6–41.9

[1] Revenues are actually projections from expenditure patterns, since expenditures can be separated into capital and operating expenditures whereas revenues cannot be. No estimates were available for airports, other rail or port development, although some discussion of needs is provided in the text.

[2] In one case of water supply and wastewater treatment, the higher estimate is based on the method which assumes the state will be able to continue its current level of real spending. For highways and bridges, this method of estimation results in the lower revenue figure.

[3] In general, the figures pertain to the Metropolitan Transportation Authority only. Three hundred million was added to the MTA estimate of needs, however, to cover bus replacement costs of other systems.

[4] Water supply needs cover only 75 percent of the state's population. Revenue estimate, however, is based on expenditures statewide.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF NEW YORK

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$817	$100	$78	$995	$2,697	$2,774	$2,363	$316	$227	$2,906	$7,514	$7,741
1970	740	158	72	970	2,888	2,959	1,947	458	198	2,603	7,438	7,636
1971	800	247	107	1,154	3,618	3,725	1,928	647	272	2,847	8,629	8,901
1972	866	358	97	1,320	4,081	4,178	2,003	842	229	3,075	9,199	9,428
1973	617	472	120	1,209	4,198	4,317	1,338	1,035	266	2,640	8,876	9,143
1974	776	562	140	1,478	4,431	4,571	1,316	1,068	268	2,652	7,952	8,220
1975	789	616	155	1,559	4,552	4,707	1,244	1,041	253	2,538	7,490	7,742
1976	671	589	93	1,353	3,657	3,750	1,068	937	143	2,148	5,847	5,990
1977	565	517	93	1,175	3,340	3,432	866	773	136	1,776	5,046	5,182
1978	711	559	144	1,414	2,929	3,073	917	762	192	1,871	3,955	4,147
1979	965	635	110	1,709	3,292	3,401	1,044	771	133	1,948	3,911	4,044
1980	1,063	811	110	1,983	3,681	3,791	1,005	908	123	2,036	3,925	4,047
1981	1,455	680	114	2,249	4,305	4,419	1,387	716	118	2,221	4,375	4,493

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative Distribution of Capital Outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	18,100	130.55	17.46	12.52	160.53	415.14	427.66	0.31	0.04	0.03	0.38	1.00
1970	18,241	106.73	25.12	10.87	142.72	407.77	418.64	.25	.06	.03	.34	1.00
1971	18,173	106.09	35.62	14.98	156.69	474.84	489.82	.22	.07	.03	.32	1.00
1972	18,104	110.65	46.53	12.67	169.85	508.10	520.77	.21	.09	.02	.33	1.00
1973	18,036	74.21	57.38	14.77	146.36	492.15	506.91	.15	.11	.03	29	1.00
1974	17,967	73.25	59.43	14.90	147.58	442.60	457.50	.16	.13	.03	.32	1.00
1975	17,899	69.49	58.15	14.13	141.77	418.43	432.56	.16	.13	.03	.33	1.00
1976	17,831	59.89	52.56	8.02	120.47	327.90	335.92	.18	.16	.02	.36	1.00
1977	17,762	48.76	43.53	7.68	99.97	284.06	291.74	.17	.15	.03	.34	1.00
1978	17,694	51.83	43.09	10.84	105.76	223.55	234.38	.22	.18	.05	.45	1.00
1979	17,625	59.24	43.72	7.57	110.54	221.90	229.47	.26	.19	.03	.48	1.00
1980	17,557	57.26	51.74	6.99	115.99	223.53	230.52	.25	.22	.03	.50	1.00
1981	17,489	79.33	40.94	6.74	127.01	250.18	256.92	.31	.16	.03	.49	1.00

NORTH CAROLINA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Content

North Carolina has been growing at a pace somewhat slower than that of its region but substantially faster than the nation as a whole. A population increase of between 17–25 percent is expected by 2000.

The state's economy currently depends heavily on manufacturing. Even so, the state is now predominantly rural and small town in nature. It is likely, however, that over the next 20 years, the state will move towards a more urban settlement pattern. This means that a greater percentage of the population is likely to become dependent on public (as opposed to private) infrastructure systems.

While the economy has been relatively strong, per capita income in the state remains well below the national average.

B. The Capital Planning Process

North Carolina's state government has no ongoing, coordinated capital improvement planning process. On the other hand, a recent Governor's Blue Ribbon Commission on transportation needs and financing arrayed substantial information on needs and revenues and presented an array of policy options.

C. General Government Structure

North Carolina has a relatively simple and flexible local government structure. Almost all local government functions are provided by cities or counties. There are very few special districts. The state government plays a relatively strong financial role. It is directly responsible for a relatively high proportion of all state roads and unlike many states, provides some financing for *most* categories of infrastructure.

II. HISTORICAL CAPITAL INVESTMENT

Infrastructure expenditures by the state government appear to be declining. Whereas capital expenditures have averaged 9 percent of the state's budget over the past decade, they account for 6–7 percent of the budgets for 1983, 1984 and 1985. In the past, significant funding has been generated through state funding for capital improvement.

III. FUNCTIONAL DESCRIPTION

A. Transportation

1. *Highways and Bridges.* North Carolina has 92,303 miles of road and 15,000 bridges. Over 80 percent of the roads and all bridges are state-maintained. While all of the estimates pertain to the state system only, coverage is relatively complete given the extensive state government role in this functional area.

The governor's Blue Ribbon Commission noted that the state has fallen behind in its effort to maintain roads or bridges. Whereas the state should be resurfacing roughly 2600 miles of road per year, between 1974 and 1981 it actually averaged roughly half that amount. It has been estimated that 17 percent of the primary system, 13 percent of the secondary system and 20 percent of the urban system need heavy resurfacing. Light surface treatment is required on a significant part of the system.

The governor's commission suggested a number of options for dealing with the state road system. None included major construction of new roads. The most ambitious package would upgrade all existing roads to a high level of standards and would cost $26.9 billion 1983 and 2000. At the low end, an option costing $10.5 billion was considered, which would maintain existing roads but involve no upgrading despite expected growth in the state. The commission's recommended spending package of $18.9 billion is the need estimate used in this report.

Funding for highways and bridges comes from a special fund fed by gasoline taxes, license charges and fees, and federal grants. Gas tax receipts have failed to keep pace with inflation as motorists restricted use and shifted to fuel-efficient vehicles in response to sharply rising gas prices. The state recently increased their gas tax three cents per gallon and raised the price of licensing and fees to replenish the fund. Based on current rates of tax, the commission estimated a total revenue stream over the next 18 years of $13.8 billion.

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[1] Based on Edward Kaiser, William J. Drummon, Kathleen M. Heady with Alice Garland-Swink, "North Carolina Infrastructure Study: Transportation, Water and Sewer", July 1983.

The shortfall in highway funding is projected at $5 billion. Expected revenues would have to increase by more than one-third to meet the state's highway needs.

2. *Mass Transit.* The level of capital investment required to meet public transportation needs is $397 million over 18 years. This includes the cost of new and replacement vehicles for the state's urban fixed route systems as well as rural systems serving the transportation disadvantaged. It does not include the cost of operating subsidies likely to be necessary to keep the systems running.

No estimate of total revenues, which would include federal grants, state grants, user charges and other local contracts are available. The governor's Blue Ribbon Commission estimated the appropriate state share of the cost of meeting transit needs to be $39.7 million. Based on past expenditures trends, it is estimated that without a change in policy only $8.5 million would be available from state funds.

3. *Airports.* Airport investment needs were estimated at $603 million. Again no estimate of total revenues was available. Based on past levels of expenditure by the state, however, it was estimated that $63 million would be available in state funds, an amount $77 million short of what the governor's commission recommended as the appropriate state's share of meeting needs.

4. *Railroads.* As in most states, public involvement with respect to railroads consists of efforts to forestall line abandonments. As much as $15.7 million in the form of operative subsidy and grants for rehabilitation might be required to keep all segments of the existing system operating.

The governor's commission envisioned a possible investment of $19.5 million in line rehabilitation only to maintain service on selected parts of the system of greatest importance to users. assuming continuation of current levels of state expenditures, some $1.8 million are likely to be available for this purpose, leaving a shortfall of $17.7 million between 1983 and 2000.

B. Water Supply, Distribution and Treatment

In general, North Carolina has sufficient water supplies; but with its growing population, continued industrial development and dispersed population pattern, a significant investment will be required in systems development to cope with a projected doubling of consumption between 1970 and 2000. By 2000, 96, or 22 percent, of municipal systems are expected to have demand in excess of their treatment capacity. While not as widespread a problem, some systems are also approaching the limits of their present water supply watershed capacities.

A statewide estimate of needs is available for the years 1983 to 1987, but not for the outyears. Assuming that 30 percent of the short-term estimates are backlogged needs, an annual investment requirement of $91 million is estimated. If annual needs remain at this level, total needs through 2000 total $1.8 billion.

If federal funding remains constant at current levels, if the state continues to support local water projects as they have in the past and if local funding follows the upward trend established over the last 12 years, then $1.7 billion would be available to finance water supply needs, leaving a gap of $144 million. If local government only makes available the average for the past 10-year period, the shortfall will increase to $444 million.

C. Wastewater Collection and Treatment

North Carolina's estimate of needs is based on investments required to meet federal law. Of the state's municipal treatment facilities, almost 50 percent and 90 percent of industrial waste water still has not met water quality standards and there are development moratoria in more than 100 towns because of inadequate waste treatment.

While wastewater collection and treatment is a local responsibility in North Carolina, the state has issued bonds and provided financing for half the non-federal share of wastewater projects.

Using EPA's 1982 needs assessment, an investment of $1.7 billion will be required through 2000 to meet both backlog and growth-related needs.

Two methods were used to estimate revenues. The first method starts with an estimate of likely federal funding and calculates the required state-local match. The second method uses trend line analysis to determine likely levels of state-local revenues available for this purpose. The two methods produce revenue estimates ranging from $1.562 billion to $1.634 billion, leaving a gap of $140 to $212 million over the 18 year projection period.

IV. Summary and Conclusions

North Carolina needs to spend approximately $23.5 billion on transportation, water supply, and wastewater collection and treatment systems between 1983 and 2000. Between $16.8 to $17.2 billion should be available to finance these needs. the biggest gap is for highways, where projected revenues fall short of needs by $5.1 billion.

NORTH CAROLINA PROJECTED CAPITAL INVESTMENT NEEDS AND REVENUES, 1983–2000

[In millions of 1982 dollars]

	Needs	Revenues	Gap
Highways	18,900	13,800	5,100
Public transit	397	[1] 8	
Airports	603	[1] 63	
Rail	20	2	
Watersupply	1,829	1,312	144–444
Wastewater	1,744	1,384	140–212
	23,494	16,569	

[1] State revenues only.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF NORTH CAROLINA

[Dollars in million]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$213	$19	$14	$246	$478	$492	$616	$60	$41	$717	$1,332	$1,372
1970	219	23	19	262	511	531	577	67	53	697	1,317	1,371
1971	258	23	21	302	557	578	622	60	53	736	1,330	1,383
1972	277	26	23	326	569	592	641	61	54	756	1,283	1,337
1973	283	33	29	344	591	620	613	72	64	750	1,249	1,313
1974	245	41	37	323	639	676	415	78	71	564	1,147	1,218
1975	281	55	62	398	830	892	443	94	102	638	1,366	1,467
1976	369	59	100	528	1,002	1,102	588	94	154	835	1,602	1,756
1977	307	54	109	470	887	996	470	81	160	712	1,341	1,501
1978	382	52	70	504	935	1,005	493	71	93	657	1,263	1,355
1979	441	76	85	602	1,048	1,133	477	93	103	673	1,245	1,349
1980	413	120	73	606	1,078	1,152	391	134	82	607	1,150	1,231
1981	292	46	173	511	953	1,126	279	48	179	505	968	1,148

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	5,005	123.10	12.01	8.12	143.23	266.09	274.21	0.45	0.04	0.03	0.52	1.00
1970	5,084	113.48	13.15	10.48	137.11	259.12	269.60	.42	.05	.04	.51	1.00
1971	5,163	120.54	11.71	10.28	142.53	257.51	267.78	.45	.04	.04	.53	1.00
1972	5.242	122.32	11.73	10.24	144.28	244.79	255.03	.48	.05	.04	.57	1.00
1973	5,321	115.29	13,55	12.07	140.90	234.77	246.84	.47	.05	.05	.57	1.00
1974	5,400	76.91	14.45	13.07	104.44	212.46	225.53	.34	.06	.06	.46	1.00
1975	5,479	80.78	17.09	18.53	116.40	249.24	267.76	.30	.06	.07	.43	1.00
1976	5,558	105.74	16.83	27.73	150.31	288.25	315.98	.33	.05	.09	.48	1.00
1977	5,637	83.38	14.44	28.43	126.25	237.82	266.26	.31	.05	.11	.47	1.00
1978	5,716	86.22	12.38	16.25	114.85	220.89	237.14	.36	.05	.07	.48	1.00
1979	5,795	82.27	15.99	17.86	116.12	214.88	232.74	.35	.07	.08	.50	1.00
1980	5,874	66.55	22.80	13.91	103.27	195.71	209.62	.32	.11	.07	.49	1.00
1981	5,953	46.79	8.05	30.08	84.91	162.69	192.76	.24	.04	.16	.44	1.00

OHIO [1]

Profile of State Infrastructure Requirements

I. CONTEXT

The infrastructure of Ohio, like most states in the Industrial Belt, is aging and in need of repair. The state has suffered with a high rate of unemployment and outmigration in the 1970s and especially in the early 1980s.

Socioeconomic background. Between 1960 and 1970, Ohio's population increased by 9.8 percent; the rate of growth between 1970 and 1980 slowed to 1.3 percent. Nationally, the comparable figures are 14.2 percent and 7.9 percent for the two decades respectively. Projections to 1990 and 2000 indicate that Ohio's growth rate will be quite small, averaging about 1.4 percent per decade for the next two decades. Even so, with a projected population of over 11 million in 2000, Ohio remains one of the largest states in the nation.

The low population growth rate is largely attributable to the state's poor economic performance. Between 1973 and 1980, unemployment was fairly similar to the rate for the nation. Since 1980, the rate of unemployment has been considerably above the national average, reaching a post-Depression high of over 14 percent of the work force in January 1983.

The capital planning process. Ohio has many of the problems of the older, employment-losing states in terms of infrastructure. State and local governments are less interested in expanding the existing size of the infrastructure than they are in preserving, restoring, maintaining and repairing what has already been built. However, much of the infrastructure is old and in many cases should probably be replaced. Large capital outlays for those replacement purposes in conjunction with smaller repair and maintenance outlays comprise the basic needs of most states in the Industrial Belt. These needs, combined with a weak fiscal position, represent a major financial hurdle for the state.

The economic downturn in Ohio damaged the state's fiscal picture in fiscal year 1982 and fiscal year 1983. Cutbacks in proposed outlays and "temporary" increases in the state income and sales taxes were employed in fiscal year 1982. Facing another projected deficit in fiscal year 1983, additional cutbacks were ordered and the income tax and sales tax became "permanent" in order to avoid the pending deficit. Further, as a result of declining state fuel tax revenues (due to decreased consumption levels and more fuel efficient automobiles) tax increases went into effect over a two-year period between 1981 and 1982 on fuel consumption to generate sufficient funds for Ohio's highway programs.

II. HISTORICAL CAPITAL INVESTMENT

Between fiscal years 1976 and 1982, the state of Ohio increased expenditures by over 68 percent (when the inflation rate, as measured by the Consumer Price Index, increased by 69.6 percent). The annual increases in capital expenditures have been erratic ranging from a low of 2.5 percent to over 13 percent on three different occasions between 1976 and 1982. By far the largest increase in outlays is projected at 26.3 percent for fiscal year 1982–fiscal year 1983.

III. FUNCTIONAL DESCRIPTIONS

The Ohio case study examined the transportation, water, and sewer infrastructure components in addition to a limited analysis of solid waste disposal.

A. Transportation

The transportation infrastructure elements are summarized below:

1. *Highways and bridges.* There are approximately 110,820 miles of streets, roads, and highways in the state of Ohio. The state has responsibility for about 19,000 miles, or 17 percent of the total. Linking the system are 14,327 bridges of 10 feet or more with the state assuming responsibility for 81 percent. The remainder of the highways and bridges are primarily the responsibility of counties, townships and cities.

Using the five-point Present Serviceability Rating (PSR) for Ohio's highways found 95 percent of the urban highways and 80 percent of the rural highways under the state's Highway Performance and Monitoring System to be in "fair" condition indicating a need for maintenance and repair activities. It should be noted, however, that PSR data are not collected on a sizable amount of the urban streets and rural roads in Ohio. Approximately one percent of both rural and urban highways are "deteriorated" and in need of reconstruction of major rehabilitation. However, it is important to recognize that the vast majority of those roads classified as deteriorating are on the interstate system and account for a disproportionate share of the highway traffic in Ohio.

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[1] Based on Michael A. Pagano, "An Analysis of Ohio's Infrastructure: A Case Study," (Miami University, Oxford, Ohio: September 1983).

In assessing the infrastructure requirements in Ohio, the focus was on three time frames: the existing backlog from fiscal year 1981 to fiscal year 1983, the anticipated financing gap for fiscal year 1984 to fiscal year 1985, and projected needs in excess of revenues through 2000. Ohio was found to have unmet programmed highway needs of $6,498.1 million for the fiscal years 1981 through 1983. For bridges, unmet needs were $128.7 million. Thus, total highway and bridge backlog for the three year period is $6,626.8 million in 1982 dollars. Projected expenditures for fiscal year 1984 and 1985 indicate a future unfinanced gap of $4,239.7 million. Therefore, total unfinanced needs for fiscal year 1981 through fiscal year 1985 total $10,866.5 million.

2. *Railroads.* Of the 7,140 route miles of track in the state, over 91 percent are owned by four Class I carriers: Conrail, Chessie, Norfolk and Western, and Detroit, Toledo and Ironton. Like many midwestern states, the size of the rail system is shrinking as line is abandoned.

Most information about the needs of the Ohio rail system does not separate Ohio's share from the railroad companies' total systems. However, in 1980, ODOT estimated that deferred maintenance needs exceeded $78 million and deferred capital improvements were $169 million for total deferred needs of $248 million. Projected needs totaled $670 million with projected capital needs reaching $436 million.

3. *Mass transit.* Public transportation is provided by 16 systems serving the eight largest metropolitan areas. Nine smaller systems serve urbanized areas of under 200,000 people. Ohio has involved itself in mass transit in order to provide local matching funds for federal programs. The first state program began July 1973 when the Ohio Public Mass Transportation Grant Program went into effect providing aid for capital purposes. Based on a recent report on public transportation financing, the state's share of mass transit system financing needs for fiscal years 1982 and 1983 was projected to be $120.4 million. Only $34.1 million was spent over this period, leaving a two-year backlog of $86.3 million. For fiscal year 1984 and fiscal year 1985, the state's share is budgeted at $26.7 million and $25.7 million respectively in 1982 dollars. Total expenditures by all levels of government are projected to be 10 times this high. The projected two-year gap is $432.6 million. Combined with the $86.3 million from above, the total four-year gap is estimated to be $518.9 million.

4. *Airports.* A 1983 study suggests that the long-term viability of Ohio's airport system depends in large part on increasing airport capacity, upgrading levels of service, and providing air access to remote locations. Estimated needs are approximately $3.1 million per year. The state currently spends $550,000 per year. The difference of $2.6 million is unfinanced.

B. Water Supply, Distribution and Treatment

Over 1,600 public water supply systems exist within the state supplying over 1,438 million gallons daily to almost 9 million inhabitants. Between 1955 and 1980, per capita consumption increased by only 13 percent. The major source of water for the municipal water supply is Lake Erie. Other than total annual capital and operating expenditure data which are reported in aggregate form to the U.S. Bureau of the Census, little information exists in readily usable form. Although the water systems are generally in good condition, capital needs for replacement or renovation could not be calculated due to data unavailability. Expansion needs amount to approximately $32 million per year.

C. Wastewater Collection and Treatment

There are approximately 800 wastewater treatment plants in the state of Ohio owned and operated by municipalities, counties and special districts. The fiscal year 1981 capital outlay totaled $552 million in 1982 dollars. Needs are projected to be $10.8 billion by 2000, or annualized needs of $670 million. Assuming the 1981 outlay to be typical suggests a gap of $118 million annually in 1982 dollars for each of the next 18 years.

IV. SUMMARY AND CONCLUSIONS

Financing needs for Ohio are broken down into three time frames: a three-year backlog corresponding to fiscal year 1981 to fiscal year 1983, a two-year unfinanced gap for fiscal 1984 to fiscal year 1985, and finally a projection to 2000. The estimates are: three-year backlog of needs, $7.4 billion; two-year unfinanced gap, $4.9 billion; gap from 1984 to 2000, $44.0 billion.

In sum, over $44 billion in 1982 dollars in unfinanced needs are projected for fiscal year 1984 to fiscal year 2000. This is a average annual gap of $2.6 billion. The major component contributing to the gap is $36.8 billion in state and local highway expenditures; this reflects stable motor vehicle fuel-tax revenues and limited bonding authority. This $44 billion gap is on top of the existing backlog gap of $7.4 billion. The author characterizes the projections to 2000 to be rough and probably inexact. The projections assume that past trends will continue unaltered, that no new revenue sources will be found, and that no change in the current tax rate would be implemented.

OHIO: ESTIMATED NEEDS AND AVAILABLE REVENUES, 1983–2000

[In millions of 1982 dollars]

	Needs	Revenue
Highways	47,367	9,877
Other transportation	4,096	920
Sewer	10,863	8,857
Water	N/A	N/A
Total	N/A	N/A

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 to 1981, FOR THE STATE OF OHIO

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	water	Subtotal	All government no water	All government plus water	Highways	Sewerage	water	Subtotal	All government no water	All government plus water
1969	$558	$71	$54	$683	$1,265	$1,319	$1,614	$225	$157	$1,996	$3,524	$3,681
1970	555	89	47	691	1,352	1,399	1,460	258	130	1,848	3,482	3,612
1971	537	70	52	660	1,317	1,369	1,295	183	133	1,611	3,140	3,273
1972	498	94	43	635	1,329	1,372	1,152	222	102	1,476	2,996	3,098
1973	441	74	51	567	1,208	1,259	958	163	114	1,234	2,555	2,669
1974	501	99	56	655	1,289	1,345	849	187	108	1,144	2,313	2,421
1975	520	114	54	688	1,685	1,739	820	193	87	1,100	2,772	2,860
1976	558	101	57	716	1,887	1,944	888	161	88	1,137	3,016	3,104
1977	468	129	58	655	1,775	1,833	718	194	85	996	2,681	2,766
1978	506	318	78	902	1,816	1,894	653	434	104	1,190	2,453	2,556
1979	586	417	73	1,076	2,031	2,104	634	507	89	1,230	2,414	2,502
1980	645	510	94	1,249	2,425	2,519	610	571	105	1,286	2,585	2,690
1981	577	521	105	1,203	2,468	2,573	550	548	108	1,207	2,508	2,616

Fiscal year	Population (thousand)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	10,643	151.68	21.12	14.78	187.58	331.08	345.86	.44	0.06	0.04	.054	1.00
1970	10,657	137.02	24.17	12.23	173.41	326.71	338.93	.40	.07	.04	.51	1.00
1971	10,671	121.32	17.16	12.47	150.96	294.26	306.73	.40	.06	.04	.49	1.00
1972	10,685	107.83	20.78	9.53	138.14	280.44	289.97	.37	.07	.03	.48	1.00
1973	10,699	89.54	15.21	10.63	115.38	238.82	249.44	.36	.06	.04	.46	1.00
1974	10,713	79.22	17.48	10.06	106.75	215.89	225.95	.35	.08	.04	.47	1.00
1975	10,727	76.45	17.97	8.16	102.57	258.42	266.58	.29	.07	.03	.38	1.00
1976	10,741	82.66	15.01	8.19	105.86	280.78	288.97	.29	.05	.03	.37	1.00
1977	10,755	66.73	18.00	7.91	92.64	249.32	257.23	.26	.07	.03	.36	1.00
1978	10,769	60.65	40.27	9.62	110.54	227.75	237.37	.26	.17	.04	.47	1.00
1979	10,783	58,81	47.00	8.22	114.03	223.84	232.06	.25	.20	.04	.49	1.00
1980	10,797	56.53	52.90	9.70	119.14	239.44	249.15	.23	.21	.04	.48	1.00
1981	10,811	50.92	50.73	10.03	111.68	231.99	242.02	.21	.21	.04	.46	1.00

OKLAHOMA[1]

Profile of State Infrastructure Requirements

I. CONTEXT

Population and Economy. Oklahoma is characterized by diversity.

Rural and urbanized—The western rural portion of the state is sparsely populated while the eastern urban and more industrialized portion of the state contains roughly half of the state's population. In 1950, 63 percent of Oklahoma's population lived in nonmetropolitan rural counties. By 1975, 49 percent of the state's population resided in the 11 counties that make up the Oklahoma City and Tulsa metropolitan areas.

More diversified economy—Oklahoma's economy has traditionally been based on the oil and gas and agricultural industries. While these industries, along with government, remain the state's major employers, the economic base of the state has become more balanced. In part, this is attributable to the decline in world oil prices which have adversely affected the state's economy.

Population growth and decline—Population growth has largely taken place in eastern Oklahoma while declines have been recorded in the rural western parts of the state. These trends are expected to continue due to low rural incomes, water scarcity, and declining oil and gas reserves in western Oklahoma.

Infrastructure financing considerations. The trends of urbanization and, at the same time emigration from rural counties pose different infrastructure financing problems for Oklahoma and its local governments. On the one hand, urbanization has occurred faster than local government's capacity to provide the necessary public services. At least these larger metropolitan areas have the potential to solve their infrastructure problems. Those areas which are experiencing population and economic declines face very different capital spending priorities, largely upgrading and maintenance. However, they also face a declining ability to meet these needs.

For many cities in Oklahoma, bond issue capacity is limited to general obligation bonds by the state constitution. These must be approved by the voters and paid out of the general property tax. Only one other state does not permit cities to issue revenue bonds directly. This, combined with the fact that over the past 20 years voters have not been inclined to pass large bond issues, exacerbates the financing difficulties of many communities.

One alternative which has been used is to establish public trusts. In a public trust, the city and the trust manage a particular government service that jointly and directly issues revenue bonds. This strategy has been used in financing the expansion of the Will Rogers World Airport in Oklahoma City and the Tulsa International Airport.

A major question related to Oklahoma's ability to respond to infrastructure problems is the future of the oil and gas industry. Oklahoma levies a seven percent gross production tax on oil and gas. During the 1970s, production rose only slightly but oil price increases raised the production tax revenue to $721 million in 1982 from $69 million in 1973. The current drop in oil prices have translated into a considerable loss in revenue for the state.

Federal outlays to the state have also declined. In 1982, 18 percent of all state revenues came from the federal government. In contrast, in 1973, the proportion was 35 percent.

II. FUNCTIONAL DESCRIPTIONS

The methodology used to estimate infrastructure requirements in Oklahoma was to rely on secondary sources which were supplemented with personal interviews and public officials.

A. Transportation

Transportation components addressed included highways, bridges, railroads and airports.

1. *Highways.* Oklahoma's roads and highways are rapidly deteriorating. The state highway system consists of over 110,000 miles of roads. Of this, 86,500 miles are in county roads. Of the money Oklahoma spends on transportation, 98.7 percent is

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[1] Based on Jean McDonald, Tim Adams, Steve Ballard, and Tom James, "Oklahoma Infrastructure Analysis," (Science and Public Policy Program, University of Oklahoma, September 1983).

highway spending. In 1982, 63 percent of all spending on transportation for state roads was attributable to the Oklahoma Department of Transportation (ODOT) which manages the state highway system.

ODOT's highway activities are financed by state appropriations, state earmarked revenues and federal highway trust fund appropriations. The budget of ODOT has not been established based on needs, but traditionally its state appropriation has amounted to the unrestricted funds not apportioned for other purposes. The largest component of earmarked state revenues is the gas tax, which has been 6.58 cents from 1949 to 1983; only Texas has a lower gas tax. Fifty-five percent of the tax goes directly to the ODOT with the remainder going to county and municipal programs. The federal highway trust fund is an important part of ODOT's budget, but Oklahoma received only 62 percent of the $1.1 billion the state contributed to the fund in the 1970's. In contrast, 41 states receive 90 percent or more of their contribution returned to them.

Adequate information on investment needs exists only for the state highway system. Thirty-eight percent of the state roads are presently inadequate. In addition, 17 miles of interstate and 69 miles of critically needed new roads have yet to be built. This amounts to the total backlog of 4,656 miles. Based on 1982 construction costs, $4.3 billion would be needed to eliminate the current backlog. Over the next 17 years, the ODOT estimates that needs will amount to 2,800 miles, including 164 miles of new roads, or a total projected cost in 1982 dollars of $1.5 billion. Thus, total current and anticipated investment needs are $5.8 billion. The cost to maintain existing roads over the next 17 years is $3.0 billion. Engineering and administrative needs are estimated to be $1.3 billion. Thus, total needs over the next 17 years are projected to be $10.1 billion.

Total revenue available to ODOT to the year 2000 is projected to be $7.7 billion. This means that revenue will fall short of needs by $2.4 billion.

County roads are funded from federal revenue sharing and earmarked tax returns (the state gas tax and the production tax). It is estimated that the funds collectively are $40 million short of their needs. Thirty-nine percent of county roads were estimated to be in critical condition in 1964.

On the municipal level, although complete data are unavailable, it is generally agreed that municipal highway funds are grossly inadequate. In 1980, the state legislature appropriated $7.4 million to improve municipal street conditions. It has been found that Oklahoma City and Tulsa are responsible for about half of total municipal highway spending in the state. Oklahoma city estimates it needs $156 million to eliminate urgent highway needs. Tulsa has identified needs calling for 80 to 90 miles of arterials and 30 miles of expressway by 2000; over the next five years, arterial improvements costing $11.5 million will be needed.

Oklahoma's turnpikes are the best financed part of the highway system. The system is primarily funded through user fees (tolls).

2. *Bridges.* Over half of Oklahoma's bridges are currently in an inadequate condition, and many are completely unsafe. The state legislature established the County Bridge Program in 1980 to provide funds and expertise to help rebuild or rehabilitate county bridges. In FY 1981, $18 million was appropriated for the program. Appropriations fell to $12 million for 1982 and 1983 and further decreases are anticipated. Fifty-three percent of the state's bridges are structurally deficient or functionally obsolete. The cost of rectifying these faults is $2.3 billion. Projections of needs to 2000 have not been made.

3. *Railroads.* Oklahoma has been concerned about track abandonment and a decline in rail service for many years. The legislature has responded to this concern by establishing the Railroad Maintenance Revolving Fund and by appropriating $22 million from the general fund for line acquisition and rehabilitation. However, since total needs have been estimated at $129 million, investment needs greatly exceed available public funds.

4. *Mass Transit.* Except for bus systems in Oklahoma City and Tulsa, Oklahoma does not have any significant mass transit. In both cities, the bus systems are operated by public trusts which are independent of the respective communities.

5. *Airports.* Oklahoma's Will Rogers World and Tulsa International Airports are the state's major commercial airports. They are financially secure and will be able to fund future needed developments. These two airports accounted for over 96 percent of the air carrier enplanement in Oklahoma in 1975. The smaller general aviation airports are in much worse condition, badly maintained, and unable to serve current demand. These smaller facilities, however, primarily serve leisure flying rather than the general public.

B. Water Supply, Distribution and Treatment

The diversity of Oklahoma is in part related to weather patterns which translate into water supply and distribution issues. Eastern Oklahoma is a humid area with an average yearly rainfall of up to 56 inches. By contrast, western Oklahoma is a semi-arid region with little precipitation (15 inches per year in the Oklahoma Panhandle). Thus, there is abundant water supply in the east and a scarcity of supply in the west.

Ground water is a major source of supply for municipal, industrial and agricultural needs. In particular, ground water supplies about 61 percent of the total water use in the state. Eighty percent of the water used for irrigation is from ground water sources, the prime source being the Ogallala Aquifer. Water in the aquifer is being pumped out soon become economically prohibitive. Investment needs for water resources throughout the state amount to nearly $3.8 billion in 1982 dollars.

Eastern Oklahoma has an abundance of supply, but, throughout the state, many communities have problems with water distribution and treatment facilities. The state has identified 350 communities, most of which are in eastern Oklahoma, with water distribution and treatment problems. The estimated cost to correct these problems is $400 to $500 million.

C. Wastewater Collection and Treatment

Oklahoma has a total of 529 municipal treatment facilities with a total capacity of approximately 100 gallons per person per day. Despite the aid of federal funds (EPA grants amounted to $260 million from 1976 to 1983), the sewage treatment needs of the state's cities and towns have not been met. It is estimated that 700 communities were having problems with wastewater treatment in 1982. Grant applications to EPA for sewage treatment needs totaled nearly $300 million in 1983; only $21 million is available from EPA. Some financial assistance is expected from the new Statewide Water Revolving Fund which has the potential to generate $250 million on low interest loans, but the money is for water development as well as sewer projects.[2]

III. SUMMARY AND CONCLUSIONS

INFRASTRUCTURE NEEDS AND REVENUES, 1983 TO 2000

[In millions of 1982 dollars]

	1983	1983 to 2000
Total infrastructure needs	13,498	18,421
Total revenue:		
Federal	182	3,092
State	452	7,956
Local	169	234
Total	804	11,283
Surplus or (deficit)	(12,694)	(7,138)

The infrastructure needs identified above are probably underestimated as is the size of the long term gap between needs and revenues. This is largely due to the fact that highway needs and revenues account for the major portion of the data in the table and are the only needs projected to 2000. Given the projected rate of population growth in Oklahoma of 18 percent between 1980 and 2000, increasing infrastructure needs should be anticipated at the local level for both water and sewer.

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[2] This study also addresses solid hazardous waste management needs.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF OKLAHOMA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$125	$6	$8	$140	$234	$242	$362	$20	$24	$405	$652	$676
1970	143	9	12	164	275	287	377	25	34	436	708	742
1971	121	9	14	144	281	295	291	24	36	352	670	706
1972	110	6	24	139	266	290	254	14	56	323	600	656
1973	140	10	19	169	300	319	304	21	43	368	633	677
1974	140	15	28	183	385	413	237	29	54	320	690	744
1975	153	14	24	191	466	490	241	24	38	303	767	806
1976	145	36	30	211	464	495	231	57	47	334	742	789
1977	152	58	30	240	492	522	232	87	44	364	743	788
1978	155	41	36	232	468	504	200	56	49	304	631	680
1979	201	55	50	306	593	643	217	66	61	345	704	765
1980	244	72	47	362	749	796	230	80	52	362	799	851
1981	278	52	43	373	778	820	265	55	44	364	790	834

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	2,512	144.03	7.77	9.54	161.34	259.61	269.15	0.54	0.03	0.04	0.60	1.00
1970	2,559	147.15	9.88	13.27	170.30	276.63	289.89	.51	.03	.05	.59	1.00
1971	2,606	111.75	9.34	13.93	135.03	256.95	270.89	.41	.03	.05	.50	1.00
1972	2,652	95.62	5.15	21.12	121.90	226.06	247.19	.39	.02	.09	.49	1.00
1973	2,699	112.53	7.79	16.02	136.34	234.73	250.75	.45	.03	.06	.54	1.00
1974	2,745	86.26	10.65	19.63	116.54	251.40	271.03	.32	.04	.07	.43	1.00
1975	2,792	86.38	8.54	13.77	108.69	274.78	288.55	.30	.03	.05	.38	1.00
1976	2,839	81.24	20.12	16.47	117.83	261.42	277.88	.29	.07	.06	.42	1.00
1977	2,885	80.47	30.23	15.33	126.03	257.67	273.00	.29	.11	.06	.46	1.00
1978	2,932	68.28	18.98	16.57	103.83	215.40	231.96	.29	.08	.07	.45	1.00
1979	2,978	72.93	22.22	20.56	115.72	236.37	256.93	.28	.09	.08	.45	1.00
1980	3,025	76.18	26.49	17.12	119.79	264.14	281.26	.27	.09	.06	.43	1.00
1981	3,072	86.27	17.86	14.38	118.50	257.30	271.68	.32	.07	.05	.44	1.00

OREGON [1]

Infrastructure Needs and Resources

I. BACKGROUND

A. Population and Economic Context

Along with the other Pacific Coast states, Oregon's population increased rapidly during the 1960's and 1970's, reaching 2,633,000 in 1980. Development is heavily concentrated within the Willamette Valley, which contains 11.3 percent of the state's area, three of its four metropolitan areas and 69 percent of its population.

While the state has decreased its overall level of dependence on the lumber and wood products industry, the performance of that industry, which is cyclically sensitive, still largely determines how well the state is doing. Oregon has been hit harder and over a longer period of time than most states by the current national recession. The state's per capita income has dropped below the national average and its unemployment rate is above the average.

The weak performance of the economy has resulted in serious budget problems for state and local governments. The state has been forced to cut its budget and raise taxes.

The current forecast shows the state's economy improving, but only slowly. The Oregon economy is not expected to regain its 1979 peak until 1987.

B. Capital Planning and Budgeting

Oregon does not have a central state planning agency. Specific functional planning activities are undertaken by individual state agencies. Although several agencies maintain data bases and have a "good feel" for needs, the researchers found a lack of statewide data and no commonality of terms and concepts regarding infrastructure needs.

Much of the responsibility for infrastructure is vested in Oregon's 36 counties, 243 cities and numerous districts, particularly those associated with water, sewer, port, transit and irrigation. Data on local government infrastructure needs and resources prepared by individual local governments were found to be fragmented.

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and Bridges.* Oregon has 121,500 miles of state highways, county roads and city streets. The State Highway Division does biennial surveys of the state road system. The most recent survey shows that 47 percent of mileage is classified as poor or very poor. This represents an improvement since 1978 when 56 percent of the road system was thus classified. The state estimates two levels of needed investment—one sufficient to maintain present conditions, the other designed to improve conditions. Even the latter, however, would leave a significant portion of pavement in deteriorated condition. Estimated annual investment requirements range from $159 million to $289 million.

A recently completed survey of trafficway needs by counties indicated that approximately $512 million in capital expenditures will be needed in the next 10 years to preserve the hard-surface county roads in the state. Extrapolated to 2000 and adjusted to 1982 dollars, a total investment of $976 million would be required for county-maintained roads. Investment needs on city streets were estimated by assuming that they would bear the same relationship to county-level investments as in past periods. Using this method, investment needs of $650 million through 2000 were identified.

Based on short-range estimates of federal apportionments and discretionary grants, the researchers assumed that $3,250 million would be available to Oregon from federal sources between 1983 and 2000. Based on historical levels of commitment to capital outlay, the researchers estimate $380 million would be available from state sources. They note, however, that this figure cannot be reached unless additional revenue sources are provided. (Under current law only $130 million would be available, and substantial amounts of federal aid would be fore gone.)

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[1] Based on the Bureau of Governmental Research and Service, "Infrastructure Needs and Resources of Selected State and Local Government Programs in Oregon" (Eugene Oregon: University of Oregon, April 1983)

Local revenues available for roads were estimated at approximately $1,200 million by assuming that historical levels of capital spending per capita are maintained. Revenues through 2000 are estimated to total $4,837 million. This figure is 29 percent less than the $6,828 estimated level of investment required.

2. *Airports*. There are 103 public-use airports in Oregon—36 controlled by the state, 8 by port districts, 34 by cities and countries, 21 by private owners and 4 by the U.S. Forest Service.

The Oregon Aeronautics Division, the first state aviation agency in the U.S., recently completed a system-wide evaluation of the airports' current conditions and capacities and projections of specific needs to 1993. The researchers drew on this plus a more detailed planning study prepared by the Port of Portland.

The Oregon Aviation System Plan includes 90 airports—80 existing and 10 new. It identified 1,178 specific airport improvement projects which should be undertaken prior to 1993. If the average annual rate of need indicated in the airport plans for the 1982–1993 period were to continue to 2000, then investment needs are estimated to total $367 million.

The best estimate of federal revenue availability through 2000 is $186 million. Unless tax rates and fees are increased at the state level, existing sources will not yield enough to cover operations and maintenance costs. Hence, no state funds are assumed available for state aid to non-state airports or for capital improvements at state owned airports. The Port of Portland estimates that long-term leases with air carriers will generate enough revenue to meet their capital needs. No information was available on which to base as estimate of other local revenues available. The total estimate of available revenues is $294 million.

3. *Mass transit*. In 1982, there were 27 local public transporation systems in Oregon. Of these, four were serving metropolitan areas and eight were small-city fixed route systems. The largest system in the state is Tri-Met serving the Portland area. In runs approximately 560 buses over 75 routes, is constructing a 15-mile light rail system and is studying the feasibility of two other light rail routes. The other metro-area systems operate 136 buses on 46 routes. Capital needs assessments and projections by the various districts vary considerably in terms of projection period and method, and no single source of investment needs for public transit in the state exists. The researchers reviewed plans prepared by each of the major systems. These plans are project specific, and many assume expansions in service. Total investment needs 1983–2000 are estimated to total $501 million.

The only revenue projection available is for the Tri-Met system serving Portland. Revenues there are projected to fall short of needs by approximately 16 percent.

4. *Water transport and terminals*. There are 23 port districts in the state of Oregon—13 of which can accommodate shallow draft shipping, four deepwater ports and six with no terminal facilities. These port districts engage in a wide variety of activities, including building and operating marine terminals and associated backup facilities (warehouses, storages and special equipment) dry docking and ship repair, construction, operation of pleasure boat marinas and commercial fishing moorage, and other activities less directly associated with water transportation. Water transportation needs, exclusive of dredging and jetty construction (viewed as the responsibility of the Corps of Engineers) were assessed by interviews with managers of the port districts.

Projected capital investment needs for the deep draft ports are estimated at $329 million. An additional $20 million is estimated as needed by the shallow draft port facilities.

Port districts' capital investments are fully financed at the local level by user charges, private investment for special purpose facilities, transfers from other port activities and property taxes.

It appears that the Port of Portland will be able to finance its projected capital improvement needs from current revenue. A shortfall of approximately $77–$97 million is indicated for marine terminal expansion and replacement at Oregon ports.

B. Water Supply

Oregon is a state of rainfall extremes, ranging from over 100 inches per year in some coastal locations to less than 12 inches per year in eastern desert locations. Reservoirs may be required in all areas—in arid areas to store water for use in dry years and in rainy areas to reduce flood hazards. A Water Policy Review Board is charged with the responsibility of formulating a coordinated state water resources policy that takes into account water use for power production, fishery enhancement, irrigation, municipal and industrial use.

In 1970, out-of-stream water use was estimated to total 6.7 million acre feet per year. Agriculture accounted for 81 percent of that use, self-supplied industry for 12 percent and public municipal and industrial supply for four percent. The remainder was used for rural domestic and livestock.

In 1979, about 1.9 million acres were being irrigated. This represented something of an increase over prior years, and all of the increase was due to private as opposed to public investment. With changes in the cost of power, little expansion in irrigated acreage is envisioned. Investment will be required to repair and improve existing agricultural water supplies, but no projection of cost is available.

Several surveys have been undertaken to assess the capital investment needs of the 1,500 public water systems in the state. Unfortunately, they result in quite different estimates of investment needs. One survey reports an investment of $641 million to meet the needs of 19 percent of water systems associated with supply and quality (not distribution). If extrapolated to all systems, total need might be $3.4 billion. Other surveys based on a smaller number of systems and narrower definitions of need yield lower estimates of investment requirements.

If revenues are estimated assuming water districts will be able to raise as much in each future year as they spent on a per capita basis over the last four years, then revenues through 2000 may total $1.6 billion.

C. Wastewater Collection and Treatment

Oregon has eliminated gross pollution of its waters from industrial and municipal wastewater outfalls. The state has some 340 domestic sewage treatment plants of which 215 are municipally owned. Only 21 cities with populations over 300 were without sewers and only eight of those had significant problems. Sixty-eight percent of total population is served by secondary sewage treatment or better.

Despite the number of sewers and treatment facilities, EPA estimates a total need through 2000 of $3.6 billion. Almost all of the total represents investment required in sewerage systems; only six percent is required for treatment facilities. The biggest need is for treatment and control of storm water.

The researchers note that in Oregon (as in other states) the EPA estimates do not take into account several types of investment:

(1) Collection systems to serve development new since 1972 or that can be projected as occurring by 2000;

(2) Storm sewers and drainage improvements. The EPA study includes an estimate of the cost of abating pollution from some stormwater runoff but is limited in scope geographically and excludes costs of new or improved storm sewers or drainage ways that may be required; and

(3) Repair and replacement of existing and new sanitary and stormwater conveyance and treatment systems.

EPA grants have been a primary source of funds for some Oregon sewerage facilities. State grants have assisted with some projects but the primary state assistance has been to reduce bond interest charges by making state loans to local jurisdictions at favorable state borrowing rates. Two revenue estimates are provided. The first, $600 million, is based on Oregon's share of EPA funding assuming the feds appropriate sufficient funds to pay their full share of all grant-eligible projects and matching provisions as embodied in current law. The second revenue estimate—$1.8 billion—assumes local governments will make the same real level of expenditure per capita as they have in the recent past.

III. SUMMARY

In a somewhat more comprehensive assessment than provided by most states, Oregon estimates needs of between $13.2 and $14.9 billion through 2000. Revenues are estimated to total between $7.9 and $9.3 billion.

Highways and bridges account for approximately half of the investment required. The assessment of highway needs is relatively conservative, inasmuch as it will leave significant segments of the system in less than fair condition. The estimated shortfall in this functional area is also conservative in that it assumes an increase in revenues over current law levels. Without this increase, significant amounts of federal funding assumed in the revenue estimate would be lost.

The biggest uncertainty regarding levels of need appear in the water supply and sewage treatment areas. Responsibility, particularly as regards water supply and distribution, is dispersed, and available information is incomplete and somewhat contradictory.

CAPITAL INVESTMENT NEEDS AND ESTIMATED REVENUES FOR THE STATE OF OREGON, 1983–2000

[In millions of 1982 dollars] [1]

	Needs	Revenues	Gap
Highways and bridges	6,957	5,208	1,991
Airports	367	[2] 276	73
Mass transit	501	[3] 457	131
Water transport and terminals	349	280	87
Water supply	1,700–4,000	1,700	0–1,700
Wastewater collection and treatment	3,600	700–2,000	1,800–3,000
Total	13,245–14,945	7,963–9,263	4,082–6,982

[1] Figures in this table may differ from those in the Oregon case study. Adjustments were made to match the time horizon and inflation factor to overall study guidelines.

[2] Local revenues apart from Portland International Airport not included.

[3] Includes revenues from all sources estimated for Portland only. Portland accounts for 89 percent of the needs total.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF OREGON

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$98	$14	$14	$127	$239	$253	$284	$45	$41	$370	$665	$706
1970	119	16	12	147	276	288	313	47	33	393	711	745
1971	165	31	13	209	319	332	398	81	33	512	761	794
1972	178	22	15	215	325	340	412	52	36	500	731	767
1973	184	28	17	229	497	515	400	61	39	500	1,052	1,091
1974	118	36	28	182	337	365	201	68	54	322	605	659
1975	160	72	25	256	519	544	252	122	40	414	854	894
1976	178	59	33	270	478	510	284	94	51	429	763	814
1977	122	68	29	219	501	530	187	101	43	331	757	800
1978	141	43	68	253	529	597	182	58	91	332	714	805
1979	179	73	48	300	639	687	194	89	58	341	759	817
1980	285	81	83	449	830	913	270	91	92	453	885	977
1981	292	78	82	453	823	905	279	82	85	446	836	921

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	2,038	139.52	22.09	20.08	181.70	326.34	346.43	0.40	0.06	0.06	0.52	1.00
1970	2,092	149.58	22.24	15.97	187.78	340.10	356.07	.42	.06	.04	.53	1.00
1971	2,146	185.66	37.68	15.26	238.60	354.76	370.02	.50	.10	.04	.64	1.00
1972	2,200	187.31	23.76	16.29	227.37	332.43	348.73	.54	.07	.05	.65	1.00
1973	2,254	177.37	27.02	17.21	221.59	466.54	483.75	.37	.06	.04	.46	1.00
1974	2,308	86.95	29.29	23.34	139.58	262.22	285.57	.30	.10	.08	.49	1.00
1975	2,363	106.69	51.52	16.90	175.11	361.43	378.33	.28	.14	.04	.46	1.00
1976	2,417	117.42	38.98	20.94	177.34	315.93	336.87	.35	.12	.06	.53	1.00
1977	2,471	75.86	40.94	17.37	134.16	306.28	323.65	.23	.13	.05	.41	1.00
1978	2,525	72.24	23.12	36.15	131.51	282.69	318.85	.23	.07	.11	.41	1.00
1979	2,579	75.26	34.47	22.57	132.29	294.41	316.98	.24	.11	.07	.42	1.00
1980	2,633	102.40	34.57	34.93	171.90	336.11	371.04	.28	.09	.09	.46	1.00
1981	2,687	103.76	30.60	31.61	165.96	311.06	342.67	.30	.09	.09	.48	1.00

SOUTH CAROLINA [1]

Profile of State Infrastructure Requirements

I. CONTEXT

South Carolina, a relatively small but populous state, has a population density of 103 persons per square mile. Immigration in the last decade boosted population growth to nearly double the nationwide trend. Slow rates of growth in personal incomes, however, may strain South Carolina's ability to pay for additional capital infrastructure necessary to alleviate the demands resulting from rapid population growth.

Population and economic context. The context in which infrastructure issues are being addressed includes:

Population growth—South Carolina's 1980 population of 3,122,814 was 24th in the nation. Between 1970 and 1980, the population of the state increased by 20.5 percent compared with a nationwide increase of 11.4 percent. The population in 2000 is projected to be 4.3 million. Much of this growth will be concentrated in a few counties.

Shift in economic focus—Since 1932, the state's industrial economy has surpassed agriculture as the state's chief source of employment and revenue. Textile manufacturing was once the basis of the state's industrial sector; however, the chemical and metalworking industries have recently been making substantial investments in new facilities. South Carolina's economy is largely dominated by a manufacturing sector focused towards final goods consumption.

Income—Growth in per capita income in the state is expected to be considerably slower than that experienced in the previous 20 years. Median family income in South Carolina is low by both regional and national standards.

Tax burden—The tax burden carried by South Carolinians is approximately 89 percent of the median carried by the population nationwide. However, in the period between 1966 and 1976, South Carolina ranked ninth in the percentage amount of state and local tax increases.

Infrastructure planning. South Carolina experienced a large increase in state bonded indebtedness during the 1970s. This gave rise to concerns over the state's capital budgeting process and a Joint Bond Review Committee was established. However, South Carolina still does not have a comprehensive program for assessing future capital needs and for determining how those needs can be met. Lack of a strong executive authority in the state will probably hamper establishment of a comprehensive planning process.

II. FUNCTIONAL DESCRIPTIONS

Investment needs for transportation, water supply and wastewater treatment have been identified, Funding requirements and sources of revenues have also been studied, however, only on a general basis.

A. Transportation

Transportation components addressed in the South Carolina study included highways and bridges, public transit and airports.

1. *Highways and bridges.* South Carolina ranks fifth in the nation in total miles of roads and streets under the state highway system. There are 38,781 miles, out of 62,371 miles of roads in the state that are under the system. Except for a general fund appropriation for public transportation, state funds used by the department come from the highway fund which are derived solely from user charges (gasoline tax, motor vehicle and driver licenses). Revenue needs and availability are summarized below:

It is estimated that maintenance of the primary and secondary road system will cost approximately $57 million per year, or $1,140 million over a 20-year period. Total revenues available over this same 20-year period are estimated at $880 million, leaving a projected deficit of $260 million.

Improvement of primary and secondary system, including the widening of narrow pavements (11,315 miles) and shoulders (3,791) where they constitute a safety risk, will cost an estimated $106 million per year, or $2,117 million cumulative between 1981 and 2000. Projected revenues available for highway improvements are estimated at $1,080 million cumulative 1981-2000, leaving a project deficit of $1,037 million.

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[1] Based on J. C. Hite, M. S. Henry, and B. L. Dillman, "Infrastructure Needs and Resources of Selected State and Local Government Programs in South Carolina" (Department of Agricultural Economics and Rural Sociology, Clemson University, Clemson, S.C., September 1983).

Completion of the interstate system within the state is estimated to cost a total of $650 million, or $97 million per year. All of the funds for these projects are apparently available with no deficits anticipated.

Bringing structurally and functionally deficient bridges to standard within the planning period will require an estimated cumulative capital outlay of $1,082 million, or $87 million annually. Currently, a $682 million cumulative deficit is projected for this category of need.

New construction, including planned metropolitan area construction is estimated to cost $21 million annually, or $420 million over 1980-2000 planning interval. The availability of revenues has not been projected.

2. *Public transit.* South Carolina has bus systems in 11 communities, of which seven are publicly owned. The seven systems operate 130 buses, and it is presumed that approximately 20 percent of those buses will need to be replaced each year to maintain a fleet in suitable operating condition. This is estimated to cost (in 1982 dollars) $3.7 million per year. An additional $6 million will have to be spent between 1980 and 2000 to add 51 buses to the system to accommodate population growth. Finally, existing capital facilities (garages, maintenance vehicles, etc.) must be maintained and augmented at an estmated annual cost of $100,000. Total estimated expenditures for public transit in the 20-year period ending in 2000 will amount to $82 million. No information is available to make reasonably reliable estimates on available funds.

3. *Airports.* There are 81 airports in South Carolina. Seventy-six of these are public use airports while five are air carrier airports. The South Carolina Aeronautics Commission prepared an airport system plan that was approved by the Federal Aeronautics Administration in June 1981. Over the 20-year planning period, about $101 million will be needed to implement the South Carolina airport plan. It is estimated that adequate state and federal funding will be available.

B. Water Supply, Distribution and Treatment

South Carolina has approximately 2,850 water supply systems. Of these, aproximately 1,000 supply water to communities, while the remainder supply schools, industries, institutions, recreational areas, etc. The state's water needs are primarily met from surface water sources; however, groundwater use is expected to increase in importance. Water demand is expected to grow from $5,777.7 million gallons per day in 1983 to 6,456.8 in 2000. New wells to meet increased water demand are expected to cost $25.7 million in the planning period 1980-2000. New reservoirs are also needed, but at this time, cost estimates are for the most part nonexistent. Preliminary figures indicate that $200 million will be spent on new reservoirs in the 20-year period. Upgrading and adding to distribution facilities will cost an additional $200 million during the same period. While some increases in the rate structure used by the various systems in acquiring revenue may be required, South Carolina's community water systems should be able to generate sufficient revenues to meet their future needs.

C. Wastewater Collection and Treatment

The Environmental Protection Agency has estimated that approximately $990 million will be needed between 1980 and 2000 to meet projected needs. The annual need is estimated at $49.5 million. Of this amount, approximately two-thirds is needed to build new treatment plants or to upgrade existing facilities. The remainder is needed for new collector lines and instrumentation. The federal government has authorized an annual funding level of $25 million, under the EPA construction grants program. Another $25 million annually is available from state sources. It is likely that these levels of funding may be discontinued and that communities will have to resort to alternative methods of financing in order to satisfy their needs.

III. SUMMARY AND CONCLUSIONS

Because of the rapid rate of population growth South Carolina has experienced in the past two decades, the existing infrastructure in the state is relatively new and for that reason, may not require the large expenditures for repair and maintenance that will be required in other states. Nevertheless, large investments in infrastructure will be required in the remaining part of this century.

Measured in 1982 dollars, the total investment need amounts to about $7 billion. This is broken down as follows:

[In millions of dollars]

Type of infrastructure	Annual need	Cumulative need 1980–2000
Highway system	270.5	5,409.0
Public urban transit	4.1	82.0
Airports	5.3	101.6
Water supply systems	21.3	425.7
Wastewater treatment	49.5	990.0
Total	350.7	7,008.3

If current federal programs are continued at funding levels (in 1982 dollars) at or near what now exist, South Carolina should be able to finance the needed infrastructure investment. A capital outlay of $181.2 million will be required from the state government and its political subdivisions, to meet these investment needs. Depending on the extent to which federal funds continue to be available for public urban transit and for water supply systems, the state and local commitment could become as much as $350 million annually. Even with continuance of existing federal programs at or near current funding levels, South Carolina will need to husband its resources carefully in order to meet all the important needs facing the state.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF SOUTH CAROLINA

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$73	$9	$7	$88	$243	$249	$210	$28	$20	$258	$676	$696
1970	90	20	12	122	257	270	236	58	33	328	663	696
1971	110	37	17	165	287	304	266	97	44	407	684	728
1972	115	42	12	169	322	335	265	100	29	394	726	756
1973	130	36	17	183	354	370	283	79	37	399	747	785
1974	149	28	23	199	457	479	252	52	43	347	820	863
1975	150	21	21	192	491	512	237	35	34	306	807	841
1976	132	26	11	168	523	533	210	41	17	267	835	852
1977	75	22	15	112	400	415	115	33	22	170	604	626
1978	96	39	18	154	369	387	124	53	25	202	498	523
1979	123	43	31	198	460	491	133	53	38	224	546	584
1980	145	41	31	218	553	584	137	46	35	218	590	624
1981	132	59	82	272	643	725	126	62	84	272	653	738

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	highways	Sewerage	Water	Subtotal	All government plus water
1969	2,538	82.62	1.04	7.95	101.61	266.19	274.14	0.30	0.04	0.03	0.37	1.00
1970	2,591	91.14	22.44	12.89	126.47	255.91	268.80	.34	.08	.05	.47	1.00
1971	2,644	100.56	36.72	16.52	153.80	258.66	275.17	.37	.13	.06	.56	1.00
1972	2,697	98.25	37.03	10.92	146.20	269.40	280.32	.35	.13	.04	.52	1.00
1973	2,749	102.95	28.60	13.62	145.18	271.86	285.48	.36	.10	.05	.51	1.00
1974	2,802	89.90	18.64	15.47	124.00	292.48	307.95	.29	.06	.05	.40	1.00
1975	2,855	82.98	12.38	11.87	107.23	282.83	294.70	.28	.04	.04	.36	1,00
1976	2,908	72.14	14.06	5.78	91.98	287.25	293.03	.25	.05	.02	.31	1.00
1977	2,961	38.92	11.02	7.42	57.41	204.11	211.53	.18	.05	.04	.27	1.00
1978	3,013	41.18	17.65	8,15	66.97	165.28	173.43	.24	.10	.05	.39	1.00
1979	3,066	43.47	17.19	12.39	73.05	178.22	190.61	.23	.09	.06	.38	1.00
1980	3,119	43.98	14.88	11.14	70.00	189.01	200.15	.22	.07	.06	.35	1.00
1981	3,172	39.64	19.48	26.58	85.70	206.01	232.59	.17	.08	.11	.37	1.00

TENNESSEE [1]

Profile of State Infrastructure Requirements

I. CONTEXT

A. Population and Economic Context

Tennessee enjoyed moderately strong economic growth during most of the seventies. Its economy, however, which is closely tied to the construction industry, has been hard-hit by the double recessions of 1980 and 1981–1982. Since 1979, state personal income has grown more slowly than in the nation, and unemployment rates are above average. The state's recovery will lag the nation's, but by 1985, the state should once again enjoy a strong economy and above average growth rates.

B. Capital Planning Process

The state government and its larger cities have capital planning procedures, and some information regarding future needs is available. Small towns and rural areas tend not to have planning systems in place. In 1976, the Tennessee state planning office worked with the state's nine economic development districts to devise regional, multi-county capital budgets. The planning effort, however, was largely supported through federal programs which have since been eliminated or curtailed.

There is a high level of recognition regarding infrastructure problems. Governor Alexander has put together a "Safe Growth Team" to investigate alternative ways of financing and building sewage treatment facilities and water supply systems. In the transportation area, the state has initiated a new program of cost sharing to assist local governments in making improvements to secondary roads. It has also assumed direct responsibility for additional portions of the state road system.

While concern over infrastructure problems is high, the current recession has forced cutbacks in the state budget. The state's capital budget in fiscal year 1982 was 37 percent below the 1978–1979 figure.

II. FUNCTIONAL DESCRIPTIONS

The researchers found that in many functional areas, forecasts of needed investment was not available for the year 2000 time frame, and extrapolations based on planning documents covering shorter time periods were required.

Important gaps in information on the cost of correcting specific aspects of the state's infrastructure problems were found in several functional areas as noted below.

In no case were revenue forecasts available to match needs estimates, so the researchers where possible, made estimates based on the historic growth of local expenditures and judgments, regarding future changes.

A. Transportation

1. *Highways and bridges.* Tennessee has 81,000 miles of road of which 50,744 are paved. As a result of a recent realignment of responsibilities, the state now has direct responsibility for the 13,100 miles of arterials and principal collectors. It also pays 75 percent of the cost of improvements required on 12,100 miles of road which are a local responsibility but which serve more than local needs. Of the paved roads in the state, 14,817 miles are in "poor condition," meaning that the pavement is badly cracked, rutted or broken in most places. Another 23,000 miles are judged to be in "fair" condition. Both of these categories which include 75 percent of all pavement, involve serious deficiences and a need for restoration or repair work. The researchers note that these deficiency statistics show Tennessee's road system to be in worse shape than most states in the southeast region.

It would take an investment of $26.9 billion in 1980 dollars, to upgrade all roads to conform to American State Highway Transportation officials (ASHTO) standards. The cost of a "tolerable" system would be $21.5 billion. In this system, certain categories of roads would be upgraded but not to the full extent suggested by ASHTO standards.

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[1] Based on Center for High Technology Management, "Infrastructure Needs and Resources of Selected State and Local Government Programs in Tennessee" (School of Administrative Science, The University of Alabama in Huntsville, October 1983).

Tennessee's road system includes 16,867 bridges, of which 54 percent are in need of reconstruction. Approximately $5.7 billion would be required to deal with the backlog of deficient bridges.

Tennessee is now investing $637 million annually in its road system. Expenditures would have to more than double to achieve either ASHTO standards or the "tolerable" road system.

The researchers suggest that some increase over current effort is likely but that revenues cannot increase enough to meet the state's needs. They project a shortfall of between $4.1 and $8.1 billion over the 18-year projection period.

These estimates of need reflect only costs associated with the existing system of roads, although they do allow for a substantial upgrading of standards. The possibility that new road mileage will be required to accommodate growth is not considered.

2. *Airports.* The Aeronautics Division of the State Department of Transportation has prepared a 20-year estimate of needed capital improvements at the state's 74 publicly owned and 78 privately owned airports. These improvements would cost $326.9 million. If the federal government pays half the costs and local revenues remain constant in real terms, then $263.5 million should be available, leaving a shortfall of some $63.4 million between 1983 and 2000.

The needs estimate does not include the cost of building new general aviation facilities even though the state plan suggests that as many as 10 may be required to meet the state's needs.

3. *Mass transit.* Eight cities run mass-transit systems, serving a combined total of 160,000 passengers per day, using 700 vehicles. Very little data is available on which to base an estimate of either needs or revenues, and there is much uncertainty regarding the future size or viability of mass transit systems given recently enacted restrictions on the use of grant funds for operating subsidies. In general, it is believed that ample funds will be available to meet capital needs, but that an operating shortfall of some $193–$403 million will have to be dealt with.

B. Water Supply, Distribution and Treatment

The state's population is served by 607 community water systems. The number of systems has grown as water utility districts are formed to serve the needs of new communities in rural and suburban counties. Many of the water utilities are small and they are ill equipped to deal with water supply problems that are arising in the state. Often systems depend on small surface streams or shallow ground water wells which provide inadequate supplies in drought periods. During the last extended dry period (summer 1980), many cities had supply problems, some so severe that water was trucked in by the National Guard.

The state could provide a list of problems in supply and a judgment that 40–50 systems need substantial upgrading to meet current demands while dozens more will need improvements to cope with growth. No estimate of the cost of coping with water supply problems was available.

C. Wastewater Collection and Treatment

There are a number of causes of pollution in the Tennessee and Cumberland River Basins.

> Non-point sources: Soil erosion from cropland is a serious problem in the western part of the state. Almost 7,000 miles of stream are 80 percent filled with sediment. Beyond the pollution problem, this leads to flooding and damage estimated at $40 million annually. Urban storm water runoff also poses some difficulty.
>
> Point sources include untreated and partially treated water from municipal or privately owned sewer systems, highly toxic pollutants from untreated industrial wastes, thermal pollution from power plants and acid drainage from unreclaimed strip mines. Currently 25 communities have sewer hook-up moratoriums because their treatment capacity is inadequate.

The estimated investment required to deal with these problems is limited to point source problems as identified in the EPA needs assessment. Tennessee requires an investment of $1.7 billion through 2000. Based on likely federal aid flows and a constant level of local per capita contributions (based on a 10-year average in nominal dollars), the researchers estimate $1.1 billion will be available to finance this need, leaving a shortfall of $636 million.

A state study has shown small towns will have a particularly difficult time coping with their sewage treatment needs. Costs per capita were estimated at $600 in municipalities of less than 1,500 in population, ranging down to $100 per capita in municipalities with more than 4,000 residents.

III. SUMMARY AND CONCLUSIONS

Including only those categories where estimates of needs and revenues are available, Tennessee requires capital investments through 2000 of $23.7 billion, or $1.3 billion annually. The estimate of revenues ranges from $14.9 billion to $18.9 billion, leaving a shortfall of $4.7–$8.8 billion over the 18-year planning period.

CAPITAL INVESTMENT NEEDS AND ESTIMATED REVENUES,[1] 1983–2000

[In millions of 1982 dollars]

Category of infrastructure	Needs	Revenues	Gap
Highways and bridges	21,495	18,435	3,060
Airports	327	263	64
Mass transit[2]	130	130	0
Sewerage	1,701	1,065	636
Total	23,653	19,893	3,760

[1] Either an estimate of needs or revenues was not available for the following categories: water supply, soil erosion, storm water runoff, new airports, new highway mileage.

[2] Estimated capital investment required by four large systems; operating subsidies, identified as the key need of mass-transit systems in the state, are excluded from the totals.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF TENNESSEE

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$200	$27	$35	$262	$568	$604	$579	$83	$103	$765	$1,584	$1,686
1970	207	23	30	260	502	532	544	67	83	694	1,293	1,377
1971	209	47	45	300	572	617	503	122	114	739	1,364	1,478
1972	203	33	30	266	517	547	469	78	71	618	1,166	1,236
1973	204	36	33	272	483	516	442	79	73	593	1,021	1,094
1974	238	62	78	378	682	760	403	118	149	670	1,224	1,373
1975	286	97	43	426	835	878	451	164	71	686	1,373	1,444
1976	329	81	41	452	870	911	524	129	64	717	1,390	1,454
1977	273	87	42	402	781	823	419	130	62	611	1,180	1,242
1978	279	78	56	413	783	839	359	107	74	540	1,058	1,132
1979	338	50	75	464	816	892	366	61	92	519	970	1,062
1980	410	61	144	615	1,007	1,150	388	69	160	616	1,073	1,233
1981	393	140	129	663	1,071	1,200	375	148	134	657	1,088	1,222

Fiscal year	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,860	150.04	21.62	26.59	198.25	410.33	436.91	0.34	0.05	0.06	0.45	1.00
1970	3,926	138.58	17.03	21.23	176.84	329.45	350.68	.40	.05	.06	.50	1.00
1971	3,993	125.94	30.48	28.62	185.03	341.54	370.16	.34	.08	.08	.50	1.00
1972	4,059	115.61	19.26	17.37	152.25	287.21	304.58	.38	.06	.06	.50	1.00
1973	4,126	107.13	19.12	17.61	143.86	247.55	265.17	.40	.07	.07	.54	1.00
1974	4,192	96.13	28.04	35.63	159.80	291.96	327.60	.29	.09	.11	.49	1.00
1975	4,259	105.97	38.47	16.57	161.01	322.52	339.09	.31	.11	.05	.47	1.00
1976	4,325	121.21	29.87	14.77	165.85	321.45	336.22	.36	.09	.04	.49	1.00
1977	4,392	95.37	29.68	14.10	139.15	268.81	282.91	.34	.10	.05	.49	1.00
1978	4,458	80.64	23.89	16.70	121.23	237.23	253.94	.32	.09	.07	.48	1.00
1979	4,525	80.91	13.48	20.26	114.65	214.40	234.66	.34	.06	.09	.49	1.00
1980	4,591	84.51	14.94	34.80	134.25	233.78	268.58	.31	.06	.13	.50	1.00
1981	4,658	80.57	31.74	28.70	141.00	233.57	262.27	.31	.12	.11	.54	1.00

TEXAS [1]

Profile of State Infrastructure Requirements

I. CONTEXT

Texas is a large and growing state which is characterized by great diversity within its borders. Second only to Alaska in area, Texas stretches 773 miles from east to west and 801 miles from north to south. In 1980, its 14.2 million residents gave it a population larger than any state but California and New York.

Due to the energy boom and other factors, Texas has experienced rapid growth. Its population increased by 22 percent from 1972 to 1980. Per capita personal income doubled by percent between 1974 and 1980, moving the state figure from 88 percent of the national average at the beginning of the period to just above the U.S. average by 1980.

Texas is expected to continue to grow at above average rates. By 2000, a population of 22.1 million is anticipated, up 56 percent from 1980. Total personal income is projected to reach $349 billion in 2000, an increase of 159 percent in real terms from 1980.

A great diversity of experience is found within the vast reaches of the state. Topography and climate range from the wet Gulf coastal plain to the arid high plains of west Texas. Settlements range from the sprawling booming cities like Houston or Dallas to tiny agricultural communities facing hard economic times due to an extended drought.

Texas has a relatively complicated governmental structure. Responsibility for infrastructure is divided among the state, 254 counties, 1,066 cities, 24 regional councils, 950 municipal utility districts and 111 special flood and draining districts, all with overlapping boundaries. Since responsibility for maintaining and constructing infrastructure is fragmented, the researchers reported great difficulty in accumulating information on either past or future levels of capital investment for specific categories of infrastructure or geographic units.

II. HISTORICAL CAPITAL INVESTMENT

Capital expenditures are expected to claim a decreasing share of the state government's budget. After peaking at 15.1 percent of the state budget in 1980, capital would decline to 9.1 percent of the budget in 1985 if recommendations of the Texas Legislative Budget Board are adopted.

No information was available on local government expenditures.

III. FUNCTIONAL DESCRIPTIONS

A. Transportation

The Texas case study presents information on highways and bridges only. No materials were readily available on aviation or mass transit needs or revenues.

1. *Highways and bridges.* There are 268,000 miles of roadways and 45,000 bridges in Texas. The state government is responsible for 71,212 miles of road (a little more than 25 percent of the system) and 29,654 bridges.

The state system has traditionally been funded via the state gasoline tax, vehicle registration fees and federal aid. Interestingly only half of the gasoline tax is dedicated for state highway use. Also the gas tax is set at five cents per gallon, the lowest rate in the nation.

Like other states, Texas found that funding sources dedicated for highway use were eroding as Americans adapted to higher fuel prices. The state government responded to this problem by setting up a mechanism for transferring dollars from the general fund in amounts required to guarantee in all future years the same amount in real terms as was available for highway purposes in 1979.

The state engages in a fairly extensive highway planning process which makes use of a 20 year time frame. Each of 24 highway districts identifies specific projects which should be undertaken to maintain the current system and meet future demands. The plan lists 5,034 projects costing a total of $61 billion. Roughly two-thirds of the total would be devoted to construction of new traffic lanes or to reconstruction projects which would increase capacity or improve roads beyond their original design standard. The state plan may be conservative in that it calls for reconstruction of only 499 bridges even though as many as 5,662 bridges have been judged to be structurally deficient or functionally obsolete.

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[1] Based on William E. Claggert, "Planning for infrastructure Needs in Texas, The Scope of the Problem" (The University of Texas at Dallas, August 1983).

If the state's plan is adjusted to this study's time frame, the investment requirement for the state road system totals $58.4 billion between 1983 and 2000.

The researchers estimate that as much as $52.7 billion might be available to meet this need, leaving an investment gap of $5.7 billion. This estimate assumes that the state budget will increase at the same rate as state personal income, even though changes in state tax laws would be required for collections to reach this level. It is further assumed that a constant share of the state budget would be devoted to highways. Note that under this scenario, the average annual investment in state highways would be substantially higher than now budgeted.

B. Water Supply, Distribution and Treatment

Texas communities are served by 1,092 municipal water systems, 800 rural water supply corporations and 750 investor owned public water supply systems.

The state has an abundant natural supply of water but it is unevenly distributed throughout the state. Some areas have too much water, while others have far too little. As a result, insuring the adequacy of water supply is considered to be a serious state problem. A state department is mandated with preparing a statewide plan concerning water supply.

Texans used 17.9 million acre feet of water in 1980. Of this total, 72 percent was used in agriculture, 16 percent for municipal supplies and nine percent in manufacturing. By 2000, a 48 percent increase in acre feet may be required. A lower level projection is also incorporated in the state plan which assumes a major reduction in water use by the agricultural sector.

Ground water sources now supply 61 percent of current needs but continued use at this level will result in serious supply problems. Ground water is being "mined"—consumed in excess of its sustainable yields—at an average annual rate of nearly eight million acre feet per year.

The state now has a dependable water supply from reservoirs that exceed current use. The excess supplies are committed, however, and the demand for surface water has been growing at the rate of six percent per year. Given the lead time involved in the development of storage capacity, it appears that immediate reservoir efforts will lag significantly behind projected use.

The state plan assumes that all future water needs will have to be met through development of additional surface supplies or conservation. Expenditure needs of $6 billion (in 1982 dollars) are projected through 2000 to meet expected demand.

C. Wastewater Collection and Treatment

Texas projects a need in the wastewater area of $5.7 billion. This figure comes out of the state planning process and includes items that are not eligible for federal assistance. The EPA 1982 needs survey (which is the base for most of the case study estimates) shows Texas requiring an investment of $4 billion in categories I to V.

IV. SUMMARY AND CONCLUSIONS

Texas projects total investment requirements through 2000 for highways, bridges, water and wastewater systems of $70.1 billion. Anticipated revenues over the same period total $59.7 billion, leaving a shortfall of $10.4 billion.

A SUMMARY OF INFRASTRUCTURE NEEDS AND REVENUES IN TEXAS (1983–2000)

[In billions of 1982 dollars]

	Needs	Revenues
Highways and bridges [1]	58.4	52.7
Water	6.0	7.0
Wastewater collection and treatment	5.7	
Total	70.1	59.7

[1] Includes state system only.

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF TEXAS

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$570	$30	$116	$716	$1,217	$1,333	$1,647	$95	$339	$2,081	$3,390	$3,730
1970	644	48	130	821	1,337	1,467	1,693	139	358	2,190	3,444	3,802
1971	684	49	130	864	1,409	1,539	1,649	128	331	2,108	3,360	3,691
1972	783	57	123	963	1,624	1,747	1,812	133	292	2,237	3,661	3,953
1973	567	64	144	774	1,662	1,806	1,230	140	320	1,689	3,515	3,835
1974	658	102	142	901	1,811	1,953	1,115	193	273	1,580	3,249	3,522
1975	838	175	182	1,195	2,155	2,338	1,322	295	297	1,914	3,546	3,843
1976	755	168	196	1,118	2,170	2,367	1,201	267	303	1,770	3,469	3,772
1977	681	245	137	1,063	2,180	2,316	1,044	367	202	1,613	3,293	3,494
1978	914	257	162	1,332	2,500	2,662	1,179	350	216	1,745	3,376	3,592
1979	1,219	372	403	1,994	3,307	3,711	1,318	452	491	2,261	3,930	4,421
1980	1,672	298	449	2,419	4,171	4,621	1,581	334	500	2,416	4,448	4,948
1981	1,738	303	487	2,527	4,266	4,752	1,657	319	503	2,480	4,335	4,838

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	10,896	151.18	8.70	31.15	191.03	311.14	342.29	0.44	0.03	0.09	0.56	1.00
1970	11,199	151.14	12.38	31.99	195.52	307.51	339.51	.45	.04	.09	.58	1.00
1971	11,502	143.41	11.12	28.79	183.32	292.15	320.93	.45	.03	.09	.57	1.00
1972	11,805	153.49	11.29	24.72	189.49	310.14	334.86	.46	.03	.07	.57	1.00
1973	12,108	101.58	11.53	26.42	139.53	290.32	316.74	.32	.04	.08	.44	1.00
1974	12,411	89.81	15.53	22.00	127.35	261.81	283.82	.32	.05	.08	.45	1.00
1975	12,714	103.98	23.23	23.36	150.58	278.92	302.28	.34	.08	.08	.50	1.00
1976	13,016	92.25	20.48	23.26	135.99	266.53	289.79	.32	.07	.08	.47	1.00
1977	13,319	78.36	27.56	15.16	121.07	247.21	262.36	.30	.11	.06	.46	1.00
1978	13,622	86.52	25.73	15.82	128.06	247.86	263.68	.33	.10	.06	.49	1.00
1979	13,925	94.68	32.44	35.26	162.37	282.21	317.47	.30	.10	.011	.51	1.00
1980	14,228	111.14	23.48	35.17	169.80	312.60	347.77	.32	.07	.10	.49	1.00
1981	14,531	114.07	21.96	34.63	170.66	298.32	332.95	.34	.07	.10	.51	1.00

WASHINGTON [1]

Profile of State Infrastructure Requirements

I. HISTORICAL CAPITAL INVESTMENT

Real capital spending per resident in Washington state by all government agencies (but excluding public utilities) has shown a generally declining trend over the fiscal years 1970–1971 through 1980–1981. This declining trend is especially noticeable for capital expenditures related to highways, streets and roads (from $105 to $55 per capita) higher education and sewerage (from $13 to $7 per capita). Expenditures for water supply have varied narrowly around an average of $9 (with a sharp decline to $5 in 1980–1981).

Over the interval 1965–1972, all general government real capital spending averaged five percent of real personal income and was never less than 4.8 percent. Since then, real capital outlay has averaged three percent of personal income. If the focus is restricted to transportation, water and sewerage systems, a similar picture emerges. Between 1965 and 1972, capital spending averaged 2.6 percent of personal income; between 1973 and 1981, it dropped to 1.4 percent.

II. FUNCTIONAL DESCRIPTIONS

A. Transportation

1. *Highways and bridges.* Washington State has 85,000 miles of roads. Only 7,000 miles are state maintained. The state highway system is in relatively good condition. According to the Department of Transportation, highways are well designed, better built and well maintained compared to those in many states. Even so, 1,200 miles of surface are classified as in poor condition and in need of immediate resurfacing to preclude further damage requiring reconstruction.

There are 2,914 bridges on the state highway system; 529 have been identified by the Federal Highway Administration as deteriorated or obsolete.

The researchers drew on a six-year spending plan prepared by the State Department of Transportation to develop an estimate of spending requirements. While the plan is clearly constrained by the anticipated availability of funds, it does identify some lower priority projects in the initial time frame and assuming an increase in investment commensurate with the growth in population during the later periods, the researchers estimate investment needs through 2000 of $6,580 million. The state's best estimate of available revenues from all sources (including the effects of increased gas taxes approved by the state legislature in may 1983) is $4,194 million through 2000. This leaves a shortfall of $2,386 million.

There are 52,000 miles of road (33,610 miles paved) maintained by local governments in Washington state. According to city and county officials these roads are not in as good condition as state roads. The local road system includes 4,351 bridges, some 30 percent of which are deficient.

The deterioration of local roads is attributable to several causes. Expenditures have been steady or declining in real terms at the same time that population growth and rising traffic volume have put increased demands on the road system. Decentralization of economic activity results in new patterns of passenger and truck traffic which necessitates new or improved roads. Also, with the deregulations of the rail industry, service to smaller communities has been interrupted, forcing an increase in short-haul truck traffic on roads not designed to carry heavy-weight vehicles.

The County Road Administration Board and Association of Washington cities each prepare estimates of needs and anticipated revenues in support of their six-year planning programs. The needs projection is based on the estimated work which is essential to bring the system to an adequate condition to handle expected traffic according to accepted safety practices and capacity analysis. No system expansion is assumed. While objective guidelines are offered, the listing of projects is based on the subjective judgments of local engineers: "Engineers are directed to list all essential projects whether funds are available or not". Using the six-year plan totals and extrapolating to the 1983–2000 time frame to adjust for population growth, the researchers estimate $5,495 million is required to maintain an adequate system of local roads. The estimate of available revenues from all sources is $3,029 million, 45 percent less than the level of investment required.

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[1] Based on Philip Bourque and Nancy Rutledge, "The Washington State Infrastructure Study" (Graduate School of Business Administration, University of Washington, July 1983).

2. *The ferry system*. The Washington state ferry system is the largest marine highway system in the United States. It is composed of 22 ferry vessels, serving eight cities and 10.7 million passengers. There are also five county ferry systems. Tolls and fares provide 61 percent of revenues needed for operations. Capital is financed entirely by taxes, bond sales and federal funds.

Between 1983 and 1989, the ferry system is projected to have investment needs of $71 million and revenues of $32 million.

B. Water Supply, Distribution and Treatment

Drinking water is currently supplied to 90 percent of Washington's residents by approximately 8,100 public water systems. City systems are the predominant suppliers, accounting for 67 percent of all revenues generated by water suppliers. Most of the remainder is accounted for by water districts. In general, drinking water is of high quality and only occasionally are there summer shortages in supply.

All water systems with more than 1,000 service connections are required to submit a water system plan to the state. These plans are to include an inventory of existing facilities, likely changes in service area and demand, and a plan of improvements needs to meet future demands. Approximately 178 plans are on the file from systems serving 75 percent of the state's population. While most systems used a 10-year planning horizon, there is a wide range among the plans submitted. Since the water supply system must also submit a financing plan, presumably the listing of planned investments is "revenue constrained."

In reporting investment requirement for this study, the researchers made no adjustment for the time horizon, but they did attempt to estimate capital needs of smaller systems. They concluded that an investment of $1,548 million is required for public water supply systems in Washington state. Based on an examination of past water supply system expenditures as reported by the census, if per capita outlays remain constant then the investment requirements sketched out in the system plans should be double. Water systems rely primarily on user fees to finance their operations. Capital investment funds come from a conbination of federal and state grants and bound proceeds. The incremental costs of expanding water systems to accommodate growth is reported to be rising steeply. The method for apportioning these costs between existing users and new arrivals is becoming quite controversial.

In addition to the water supply systems which serve residential, commercial and industrial users, Washington state relies on approximately 96 irrigation districts to provide water for some 23,000 farms and ranches with 911,562 acres of land.

Projections of need for agricultural water are difficult due to uncertainty over—

(a) The longer term prospects for agricultural products prices,

(b) The rising costs of energy used to pump water through the irrigation systems, and

(c) The continued availability of federal interest fee loans to finance irrigation district capital spending and required state matching funds.

Whether or not farm and ranch enterprises will be able to afford additional water even under current financial arrangements is subject to great debate. Based on divergent estimates provided by the Bureau of Reclamation, the State Department of Ecology and Independent Agriculture Market Assessments, the researches concluded that investment requirements might be $185 million through 2000.

C. Wastewater Collection and Treatment

In Washington state, there are 230 systems and plants which provide for the treatment of sewage and another 65 public sanitary sewerage systems which either discharge waste-water without treatment or discharge to another jurisdiction's treatment facility. In 152 communities, the primary method of dealing with wastewater was by means of individual on-site disposal, usually spetic tanks and drain fields.

While 60 percent of the state's population is presently served by sewerage authorities with facilities for wastewater treatment, EPA goals are that 88 percent be served by sewage collection and treatment systems. Presently, only 14 percent of the population is served by facilities which provide for secondary treatment, but EPA envisions that 66 percent of the population be so served by 2000.

EPA estimates that to meet the needs of the 1980 population for wastewater treatment and storm water runoff, an investment of some $5.6 billion would be required. To accommodate growth until 2000, the total bill would be $6.6 billion.

If real expenditures per capita are extrapolated through 2000 on the basis of anticipated population growth, it appears that $2.4 billion might be available to fund future needs. With cutbacks in EPA funding and likely difficulties in bonding, even this estimate may be optimistic. The shortfall in this area is a major concern of state and local officials.

III. Summary and Conclusions

Washington state estimates total investment needs of $20.5 billion between 1983 and 2000. These estimates appear to reflect better-than-average data and incorporated some allowance for expected population growth. Revenues are expected to fall short of investment requirements in the transportation and sewerage functions. The latter area, where the expected flow of revenues would have to triple if investment needs are to be met, is of particular concern.

WASHINGTON STATE: ESTIMATED NEEDS AVAILABLE REVENUES, 1983–2000

[In millions of 1982 dollars]

Function	Needs	Revenues	Shortfall
Total	20,502	11,339	9,163
Highways and bridges	12,146	7,181	4,965
Other transportation (1)	N/A	N/A	N/A
Water supply	1,733	1,733	
Wastewater collection treatment	6,623	2,425	4,198

HISTORICAL CAPITAL OUTLAYS, FISCAL YEARS 1969 TO 1981, FOR THE STATE OF WASHINGTON

[Dollars in millions]

Fiscal year	Nominal capital outlays						Real capital outlays					
	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government no water	All government plus water
1969	$209	$32	$51	$292	$532	$583	$606	$100	$148	$854	$1,482	$1,630
1970	235	36	25	296	649	674	618	104	70	792	1,672	1,742
1971	268	40	24	333	774	798	646	105	61	813	1,846	1,907
1972	300	36	29	366	648	677	694	86	70	849	1,460	1,530
1973	305	67	29	402	780	810	663	147	66	875	1,650	1,715
1974	245	54	29	328	665	694	416	102	56	574	1,193	1,250
1975	277	73	47	397	750	797	438	123	76	637	1,234	1,310
1976	231	65	228	524	708	936	368	104	351	823	1,132	1,483
1977	290	51	241	583	810	1,051	445	77	356	877	1,224	1,579
1978	285	50	45	381	963	1,009	368	69	60	497	1,301	1,361
1979	426	102	63	591	1,238	1,301	461	124	76	661	1,471	1,547
1980	505	104	62	671	1,366	1,428	478	116	69	663	1,457	1,526
1981	526	67	45	638	1,607	1,653	501	71	47	619	1,633	1,680

	Population (thousands)	Per capita real capital outlays						Relative distribution of capital outlays				
		Highways	Sewerage	Water	Subtotal	All government no water	All government plus water	Highways	Sewerage	Water	Subtotal	All government plus water
1969	3,341	181.27	30.06	44.36	255.69	443.61	487.97	0.37	0.06	0.09	0.52	1.00
1970	3,413	180.98	30.58	20.38	231.94	489.99	510.37	.35	.06	.04	.45	1.00
1971	3,485	185.45	30.19	17.63	233.27	529.65	547.28	.34	.06	.03	.43	1.00
1972	3,556	195.13	24.10	19.63	238.86	410.63	430.26	.45	.06	.05	.56	1.00
1973	3,628	182.60	40.52	18.06	241.18	454.76	472.82	.39	.09	.04	.51	1.00
1974	3,700	112.35	27.57	15.24	155.15	322.56	337.80	.33	.08	.05	.46	1.00
1975	3,772	116.02	32.68	20.13	168.83	327.31	347.44	.33	.09	.06	.49	1.00
1976	3,843	95.66	27.04	91.35	214.05	294.53	385.89	.25	.07	.24	.55	1.00
1977	3,915	113.64	19.61	90.85	224.09	312.53	403.38	.28	.05	.23	.56	1.00
1978	3,987	92.31	17.21	15.16	124.68	326.33	341.49	.27	.05	.04	.37	1.00
1979	4,058	113.48	30.62	18.75	162.84	362.49	381.24	.30	.08	.05	.43	1.00
1980	4,130	115.68	28.20	16.77	160.65	352.68	369.45	.31	.08	.05	.43	1.00
1981	4,202	119.32	16.81	11.13	147.26	388.74	399.87	.30	.04	.03	.37	1.00

APPENDIX B. ILLUSTRATIVE STAFF MODEL, NATIONAL INFRASTRUCTURE FUND

PRINCIPLES FOR A NATIONAL INFRASTRUCTURE PROGRAM

1. This would be a multi-year program. Infrastructure banks or other similar State capital financing entities would be eligible to receive federal loans in predictable annual installments for certain types of public works projects.
2. The loan principal would be fully reimbursable by the state. The interest would be borne by the Federal government.
3. The loans would be made by a central Federal entity, perhaps a National Infrastructure Fund or through the Treasury Department.
4. Funds for the national infrastructure program would be raised by Treasury through the sale of bonds.
5. Eligible project categories include transit, bridges, roads, and water and sewer.
6. Compliance will be monitored by an annual GAO audit (or other monitoring process to be determined).
7. Funds will go directly to the states. Apportionment to states would be on a formula basis. All localities within a State would be eligible to participate.
8. Funds provided through the national infrastructure program cannot be substituted for existing State and local capital commitments.
9. Funding for this program should be highlighted in a federal capital budget.

PROPOSAL FOR A NATIONAL INFRASTRUCTURE FUND

SUMMARY

Public infrastructure in the United States has been steadily deteriorating over the past two decades. This deterioration has now reached a point where it has begun to limit the nation's ability to achieve a satisfactory rate of economic growth.

Estimates of the nation's infrastructure needs vary considerably. However, most studies of the problem have concluded that these needs are substantial and that all regions of the country are affected. For just the five core systems—road networks, vehicular bridges, mass transit systems and water supply and sewage treatment facilities—estimates of annual capital needs range from several billion dollars to over $20 billion. Existing resources from state and local governments and federal grant programs will not be sufficient to provide all of the investment funds needed by these five basic infrastructure systems. A gap of at least several billion dollars annually will remain. No mechanisms are yet in place to fill this gap.

The proposed National Infrastructure Fund (NIF) could provide a major portion of the remaining funds needed. NIF involves a working partnership between federal, state and local governments to create a new pool of infrastructure capital through long-term debt issued by the federal government, with the principal being repaid from funds generated by state and local governments. This capital would be used to establish revolving loan funds for infrastructure renewal in each state. Such a mechanism, with it relatively modest cost to the federal budget, would allow state and local governments to substantially increase their infrastructure investments without overburdening their already strained fiscal capacity. In addition, each state would be left with a permanent pool of infrastructure capital after the federal debt has been repaid.

NEED FOR A NEW FINANCING VEHICLE

A major reason why the nation's infrastructure has deteriorated is the pervasive decline in the annual rate of new infrastructure investment by all levels of government. In 1971, for example, government investment in infrastructure amounted to 1.5 percent of Gross National Product. By 1981, this had fallen to 0.78 percent of GNP (after allowance for inflation)—about half the 1971 rate. Moreover, the continuation of current levels of infrastructure investment by government over the next decade will not meet projected needs.

Expanding the supply of new infrastructure capital provided by state and local governments or by federal grant programs may not be a practical way to generate the additional funds required.

Most state and local governments face severe fiscal pressure from a combination of rising operating costs and more slowly rising revenue sources. The increased demand on revenues to meet rising operating costs has resulted in less revenue being available for debt service. At the same time, the rising trend of interest rates has caused interest costs to absorb an increasing share of revenues available for debt service—from 34 percent in 1960 to 52 percent in 1981. The result is a sharp drop in the share of debt service revenues available for principal payments, which is the ultimate fiscal constraint on the amount of debt that can be issued.

State and local governments must increase their rate of investment to help close the funding gap, which many have already begun to do. While additional funds can be provided out of current revenues from taxes and user charges, most will probably be provided by issuing substantial amounts of new tax-exempt debt. Last November, voters approved the highest proportion of state and local bond issues since 1960. However, even with increased efforts at the state and local level, a significant funding gap will remain.

In short, it is difficult to justify the assumption that state and local governments can somehow find the capacity to close the infrastructure funding gap single-handedly.

There are equally compelling arguments against the assumption that the tide of "New Federalism" can be reversed to permit the substantial increases in federal grant programs needed to close this gap. Even though grant programs may be the most efficient way of providing additional funds, the need for increased annual federal budget appropriations to fund such grant programs poses serious practical difficulties in a period when the magnitude of federal budget deficits is of widespread concern. Also, there is a general consensus among many public officials that a plateau may have been reached in the overall level of federal grant programs for public works projects. These existing grant programs are vital and must be preserved, but additional ways must be found to strengthen the federal/state/local partnership if the nation's infrastructure is to support a competitive national economy.

Accordingly, it may be time for the federal government to reevaluate the ways it supports public works investment and establish new mechanisms that directly involve state and local governments in the process of raising new infrastructure capital. The National Infrastructure Fund could be one of these new mechanisms.

How the National Infrastructure Fund Might Work

The heart of the proposed NIF mechanism is a working partnership between federal, state and local governments to create a national pool of new capital for infrastructure. The actual process could be as follows:

1. NIF would be established by an act of Congress, either as part of an existing federal agency or as an independent entity.
2. NIF would be capitalized with a specified amount of long-term federal debt issued over a period of ten years or so. Interest on this debt would be borne by the federal government.
3. NIF would lend its capital to state infrastructure banks (or other state capital funding agencies), with the maturities of these loans matching the maturities of the new federal debt. NIF would be authorized to lend this capital to the states at zero interest.
4. The states would use the capital they receive from NIF to make self-liquidating interest-free loans to infrastructure projects being undertaken by state and local operating agencies. These loans would be repaid in annual installments from revenues generated by state/local taxes or user charges.
5. The states would deposit a portion of these loan payments in sinking funds set up to assure repayment of the loans received from NIF. The remainder of the loan payments would fund new loans to support additional infrastructure projects. This process of recycling the loan payments multiplies the total dollar value of infrastructure projects funded by several times the dollar value of the loans received from NIF.
6. As the loans made by NIF to the states are repaid, the funds would be used to retire the federal bonds originally issued to capitalize NIF.
7. After the federal debt is fully retired, a permanent pool of infrastructure capital would remain in the hands of the states to help fund on-going renewal and replacement of infrastructure facilities.

ADVANTAGES OF THE NIF MECHANISM

There are four main advantages in creating the national pool of infrastructure capital through the NIF mechanism.

It avoids the numerous legal, financial and institutional problems that 50 state governments and more than 10,000 local governments would encounter in trying to raise the same amount of capital through many individual debt issues.

The debt would be issued in the taxable markets, which avoids the risk of over-loading the much smaller tax-exempt market in any given year.

The federal debt issued to capitalize NIF would be fully retired when it matures with funds made available by state and local governments. This means that federal interest costs for this program are incurred only for a specific period of time rather than going on forever.

The net cost to the federal budget would be a small percentage of the total dollar value of infrastructure projects funded.

NIF'S INFRASTRUCTURE FINANCING POWER

To obtain a sense of NIF's potential effectiveness as an infrastructure financing mechanism, assume, for example, that:

1. NIF is given $10 billion worth of total loan authority by Congress, to be exercised at the rate of $1 billion per year for ten years;
2. In each of these years, NIF receives $1 billion worth of capital from the Treasury Department, which obtains these funds by issuing new 20 year bonds;
3. NIF lends this capital to state infrastructure banks or other state capital funding agencies with the maturity of these loans matching the maturity of the Treasury bonds;
4. The state banks:

    Lend out the loan proceeds they receive each year from NIF to fund infrastructure projects being undertaken by state and local operating agencies, with these loans being repaid in equal annual installments over 20 years;

    Create sinking funds out of a portion of the loan payments they receive to assure that they can pay off their loans from NIF when they are due;

    Lend out the remainder of the loan payments each year to fund more infrastructure projects.

At the end of 30 years, the results would be that:

1. All $10 billion worth of Treasury bonds will have been paid back with money made available, through NIF, by the states.
2. $23.7 billion worth of infrastructure projects will have been funded (2.4 times as much as Treasury borrowed).
3. The state banks will still have $6.7 billion worth of loans outstanding, which will be repaid in annual installments over the next 20 years. These loan balances equal the sinking fund interest earnings and represent a $6.7 billion pool of permanent infrastructure capital that the states can continue to recycle (equal to 67 percent of NIF's original $10 billion loan authorization).
4. This means that the NIF program will have leveraged the $10 billion loan authorization from Congress to make available a total of $30.4 billion worth of capital for infrastructure investments—a leverage ratio of 3.04.
5. Meanwhile, the gross cost of the NIF program to the federal budget in the peak year would be only $1.4 billion. Taking into account all of the costs and offsetting revenues, the net cost to the federal budget over the entire thirty year period would be only $7.9 billion—just 26 percent of the $30.4 billion that NIF makes available for infrastructure. This represents a budget leverage ratio of 3.9.

The following table shows the results of this $10 billion illustrative example on a year-by-year basis.

NATIONAL INFRASTRUCTURE FUND: ILLUSTRATIVE EXAMPLE [1]—SUMMARY OF RESULTS

[In millions of dollars]

Year	NIF debt			Dollar value projects funded	Gross Federal budget cost	Gross Federal budget gain	Net Federal budget impact
	Issued	Repaid	Balance				
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1984	0	0	0	0	0	0	0
1985	1,000	0	1,000	1,000	117	285	168
1986	1,000	0	2,000	1,050	238	583	345
1987	1,000	0	3,000	1,103	358	643	285
1988	1,000	0	4,000	1,158	479	705	226
1989	1,000	0	5,000	1,216	600	769	169
1990	1,000	0	6,000	1,276	721	834	113
1991	1,000	0	7,000	1,340	843	900	57
1992	1,000	0	8,000	1,407	964	968	4
1993	1,000	0	9,000	1,477	1,086	1,037	−49
1994	1,000	0	10,000	1,551	1,209	1,108	−101
1995	0	0	10,000	298	1,226	813	−412
1996	0	0	10,000	313	1,240	504	−736
1997	0	0	10,000	329	1,255	511	−744
1998	0	0	10,000	345	1,273	519	−753
1999	0	0	10,000	362	1,292	528	−764
2000	0	0	10,000	381	1,313	537	−777
2001	0	0	10,000	400	1,337	546	−791
2002	0	0	10,000	420	1,364	556	−808
2003	0	0	10,000	441	1,393	566	−827
2004	0	0	10,000	463	1,426	577	−850
2005	0	1,000	9,000	816	1,299	636	−664
2006	0	1,000	8,000	807	1,169	687	−482
2007	0	1,000	7,000	795	1,036	646	−390
2008	0	1,000	6,000	780	902	604	−298
2009	0	1,000	5,000	761	766	561	−205
2010	0	1,000	4,000	738	627	515	−112
2011	0	1,000	3,000	711	486	468	−18
2012	0	1,000	2,000	680	341	418	77
2013	0	1,000	1,000	643	193	366	172
2014	0	1,000	0	602	42	311	269
Total	10,000	10,000	....	23,663	26,595	18,701	−7,897

[1] Note: The figures that appear in this table and the two charts that follow illustrate how a $10 billion NIF Program could work. The exact magnitude of NIF's borrowing authority would be determined by Congress.

SUMMARY OF MAIN NIF FEATURES

A partnership between federal, state and local governments to create a national pool of infrastructure capital;

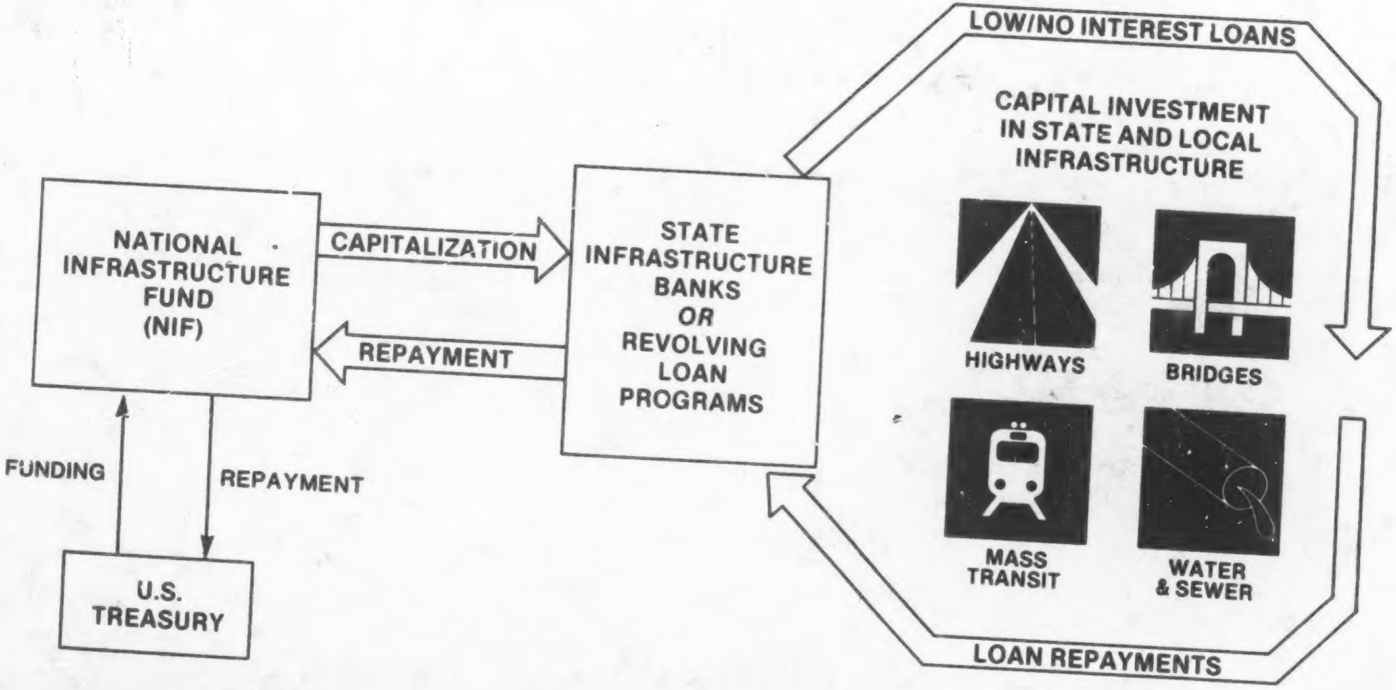
A capital pool created by federal debt that is repaid with funds provided by State and local governments;

State infrastructure banks (or other state capital funding agencies) which would cycle the proceeds of their bond sales to NIF to state and local agencies undertaking infrastructure projects by making self-liquidating loans, and which would use the loan repayments when needed to pay off their bonds issued to NIF;

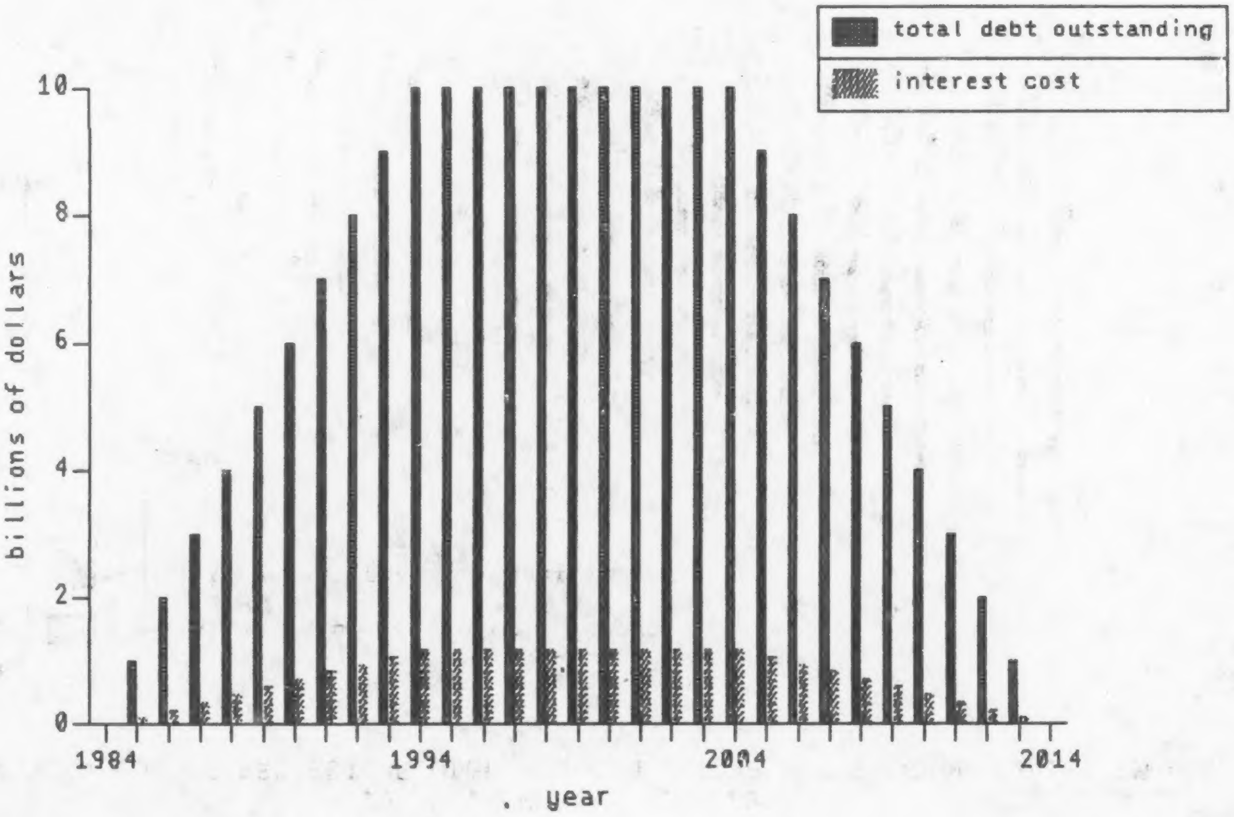
Self-liquidating federal debt with annual interest payments limited to a specific period of years; and

Prime responsibility for funding, planning and implementing infrastructure projects resting with state and local governments.

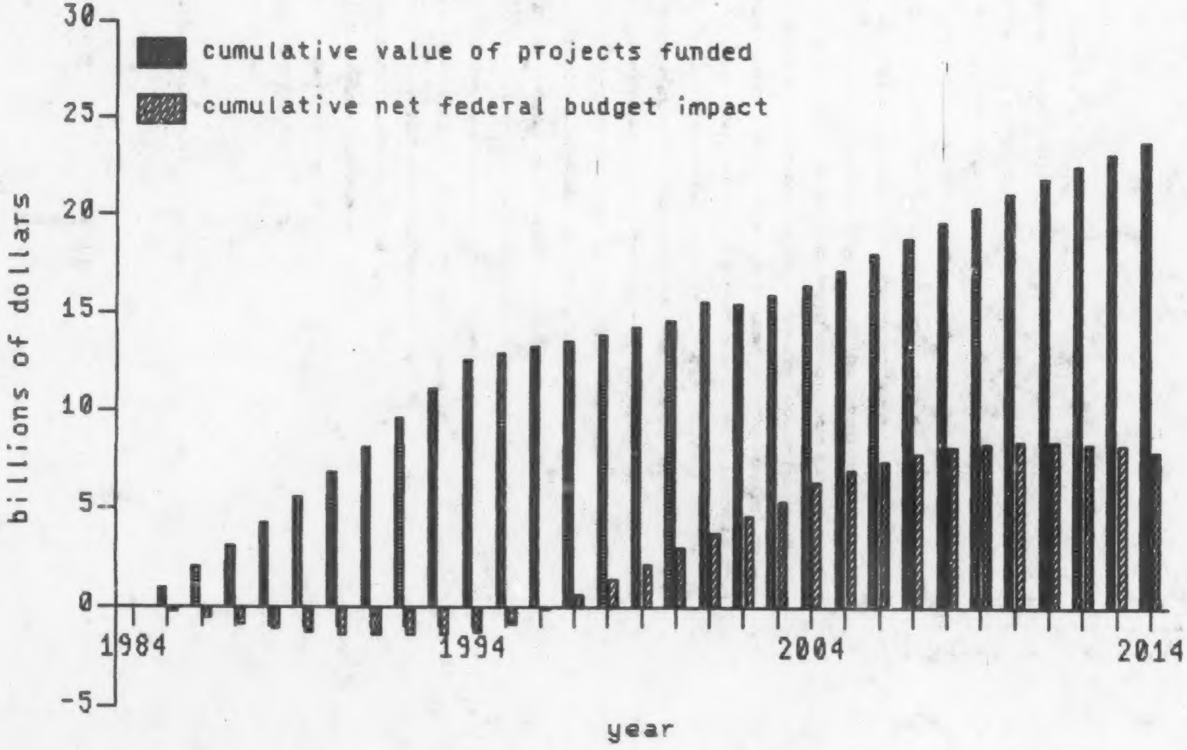
NATIONAL INFRASTRUCTURE FUND


NATIONAL
INFRASTRUCTURE
FUND
(NIF)
CAPITALIZATION
REPAYMENT
STATE
INFRASTRUCTURE
BANKS
OR
REVOLVING
LOAN
PROGRAMS
FUNDING
REPAYMENT
U.S.
TREASURY
LOW/NO INTEREST LOANS
CAPITAL INVESTMENT
IN STATE AND LOCAL
INFRASTRUCTURE
HIGHWAYS
BRIDGES
MASS
TRANSIT
WATER
& SEWER
LOAN REPAYMENTS

NATIONAL INFRASTRUCTURE FUND OPERATIONS



NATIONAL INFRASTRUCTURE FUND
CUMULATIVE VALUE OF PROJECTS FUNDED AND CUMULATIVE NET FEDERAL BUDGET IMPACT


cumulative value of projects funded
cumulative net federal budget impact
billions of dollars
30
25
20
15
10
5
0
-5
1984
1994
2004
2014
year